DECLARATION STATEMENT

RECORD OF DECISION

MANNHEIM AVENUE DUMP SITE

Site Name and Location

Mannheim Avenue Dump Site
Galloway Township, Atlantic County, New Jersey

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Mannheim Avenue Dump Site in Galloway Township, New Jersey, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision document explains the factual and legal basis for selecting the remedy for this Site. This decision is based on the administrative record for the Site. The attached index identifies the items that comprise the administrative record.

The New Jersey Department of Environmental Protection concurs with the Selected Remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial threat to public health, welfare or the environment.

Description of the Selected Remedy

The role of this response action is to address the principal threat posed by the Site, namely, the presence of contaminants in the groundwater. The groundwater contamination has the potential to migrate towards, and adversely impact, downgradient residential wells. This action addresses this threat by actively removing contaminants from the groundwater and by controlling the migration of the contaminants towards the residential wells.

The major components of the selected remedy include the following:

- Extraction of the contaminated groundwater in the shallow and deep zones of the aquifer system, with on-site treatment via air stripping and discharge of treated groundwater into the aquifer.
- Short-term monitoring of the groundwater during the design period to assess the potential migration of contaminants towards residential wells.
- Long-term monitoring of the groundwater, once the extraction/treatment/discharge system is operational, to ensure the effectiveness of the system in removing contaminants and controlling migration.
- Contingency planning to install individual carbon adsorption treatment units at residences, if monitoring indicates that groundwater contamination is threatening residential wells.

Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and it satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as their principal element.

Because this remedy will initially result in hazardous substances remaining on the site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Constantine Sidamon-Eristoff
Regional Administrator

9/27/90
Date

DECISION SUMMARY

RECORD OF DECISION

MANNHEIM AVENUE DUMP SITE

SITE NAME, LOCATION, AND DESCRIPTION

The Mannheim Avenue Dump Site (the Site) is located in a two-acre sand and gravel clearing occupying lots two and three of Block 54 in Galloway Township, Atlantic County, New Jersey (refer to Figure 1). The Site lies on Mannheim Avenue between Shiller Road and Clarks Landing Road. The Site is approximately 1500 feet southeast of the Tar Kiln Branch and two miles southwest of the Mullica River and associated tidal marsh (refer to Figure 2). The area immediately surrounding the Site is relatively flat woodlands of scrub pine and low bush. The area is within the New Jersey Pinelands Protection Area. A sand and gravel pit is located across the street from the Site and is owned and operated by Galloway Township. At least 82 residences lie within a one-mile radius of the Site. The Bethel Christian Day School is located within 5000 feet south of the Site. Many of these residences and facilities rely on groundwater wells for potable water supply.

The Cohansey Sand and the Kirkwood Formation form an important water-bearing unit used as a major source of potable water in the area. At the Site, this unit is an unconsolidated deposit of sands and gravels interbedded with clay. A semi-permeable clay layer, approximately 3 to 5 feet thick, underlies the Site at approximately 50 feet below ground surface. This layer separates the shallow zone of the aquifer system from the deeper zone (refer to Figure 3). Throughout the region, this deeper zone extends to a depth of approximately 200 to 250 feet below ground surface to a low permeability clay layer, which marks the lower boundary of this aquifer system. The depth to water at the Site is approximately 35 feet. In the shallow zone, groundwater flows in a northwesterly direction towards Tar Kiln Branch. In the deep zone, groundwater flows in a northeasterly direction towards the Mullica River.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Mannheim Avenue Dump Site was originally used as a sand and gravel excavation operation by Galloway Township for road construction material. After mining operations ceased in 1964, the excavated portions of the Site were used for waste disposal.

Beginning in 1964, Lenox China obtained permission from Galloway Township to use the Site to dispose of industrial wastes produced at its manufacturing facility in Pomona, New Jersey. The drummed wastes were deposited on the floor of the excavated portion of the Site, approximately 5 feet below ground surface, and subsequently compacted into 35 waste mounds, along with other municipal wastes, and covered with soil. Leaded porcelain fragments and household refuse was also mixed in the waste mounds.

A 1981 industrial survey report submitted by Lenox China notified the New Jersey Department of Environmental Protection (NJDEP) that hazardous wastes may have been disposed of at the Mannheim Avenue Site. The survey indicated that 55-gallon drums of trichloroethene (TCE) degreasing sludge were disposed of at the Site and in other locations. A subsequent investigation by NJDEP in 1982 revealed that many of the 55-gallon drums were exposed and deteriorating. Samples collected from the exposed drums indicated the presence of the following chemicals: TCE at 1,640 parts per million (ppm), toluene at 230 ppm, ethylbenzene at 350 ppm, methylene chloride at 220 ppm, cadmium at 22 ppm, lead at 2,600 ppm, nickel at 27 ppm, and chromium at 6 ppm.

The Site was placed on the National Priorities List in 1983. In December 1984, the U.S. Environmental Protection Agency (EPA) issued an Administrative Order to Lenox and the Township of Galloway to remove the waste material buried in the soil mounds at the Site, conduct soil and groundwater sampling, and excavate and remove contaminated soil from the Site. By August 1985, Lenox had completed the excavation of the waste material from the soil mounds. Approximately 25,000 pounds of degreasing sludge were separated from general trash and incinerated off site. Thirty-five mounds of soil remained, many with residual contamination.

In 1985 and 1986, Lenox conducted soil, groundwater, limited surface water, and domestic well sampling. This sampling showed that the principal contaminants associated with the waste at the Site were lead and TCE. Soil sampling revealed that lead was the predominant contaminant remaining within the soil mounds (at levels up to 48,000 ppm). Several of the mounds also contained small fragments of the asphaltic sludge waste which could not be separated from the soil during the initial excavation. These mounds were assumed to contain TCE as well as lead contaminants. Groundwater sampling on site revealed the presence of TCE (at levels up to 140 parts per billion (ppb)). Groundwater sampling from residential and school wells, and from the nearby stream, did not reveal the presence of any site-related contaminants. In June 1989, the 35 mounds of soil containing residual lead and TCE contamination were excavated and disposed off site by Lenox.

In July 1988 and March 1989, EPA sampled the drinking water from 25 local residential wells surrounding the Site and one well from the Bethel Christian School for volatile organic compounds (VOCs) and metals. No VOCs or metals were detected above EPA's drinking water standards.

In May 1988, EPA entered into an Administrative Order on Consent with Lenox, Inc. and the Township of Galloway to conduct a remedial investigation (RI) and feasibility study (FS) at the Site.

In February 1990, Lenox, Inc.'s contractor submitted a FS Report for EPA review and approval. EPA determined that this report was incomplete and inappropriate for public release, and for preparing a Record of Decision. Consequently, EPA tasked its contractor to prepare a FS Report to develop and evaluate alternatives for groundwater remediation more thoroughly.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI and FS Reports and the Proposed Plan for the Mannheim Avenue Dump Site were released to the public for comment on July 17, 1990. These two documents were made available to the public in the administrative record maintained at the EPA Docket Room in Region II and at an information repository at the Atlantic County Library/Galloway Township Branch. The notice of availability for these two documents was published in The Atlantic City Press on July 17, 1990. A public comment period on the documents was held from July 17, 1990 to August 15, 1990. In addition, a public meeting was held on August 7, 1990. At this meeting, representatives from EPA answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this Record of Decision (ROD).

SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

The role of this response action is to address the principal threat posed by the Site, which is the presence of TCE contamination in the groundwater at, and emanating from, the Site. The groundwater contamination has the potential to migrate towards, and adversely impact, downgradient residential wells. The purpose of this response action is to prevent current or future exposure to the TCE-contaminated groundwater, to reduce TCE concentrations in the groundwater to levels safe for drinking, and to control contaminant migration towards the residential wells.

SUMMARY OF SITE CHARACTERISTICS

The Remedial Investigation for the Mannheim Avenue Dump Site included sampling the surficial soil at the Site (after the waste mounds were removed), the groundwater in the shallow and deep zones on and off the Site, and limited sampling of the Tar Kiln Branch.

Surficial soil sampling indicated that lead was present in the soil at concentration levels within EPA's acceptable range for residential land use. This range is 500 to 1000 ppm, depending on site specific circumstances.

Groundwater sampling of the shallow and deep zones of the aquifer system (separated by a 3 to 5 foot semi-permeable clay layer at 50 feet below ground surface) indicated that TCE was the primary contaminant impacting the groundwater. TCE was detected in the shallow zone up to a concentration of 29 ppb. It is roughly estimated that the entire length of the shallow TCE plume, including the 400-foot diameter of the Site itself, is assumed to be 1000 feet, with a width of 400 feet and thickness of 15 feet. TCE was detected in the deeper zone up to a concentration of 47 ppb. It is roughly estimated that the deeper TCE plume length, including the Site, is greater than 1000 feet, and that it is 1000 feet wide and 55 feet thick. Figure 4 illustrates the approximate extent of the TCE plumes in the shallow and deep zones of the aquifer system. The maximum contaminant level (MCL) for TCE, established under the New Jersey Safe Drinking Water Act, is 1 ppb. This MCL value of 1 ppb is the drinking water standard for TCE. The areal extent of the TCE contamination in the shallow and deep zones, as defined by the 1 ppb MCL, has not been completely defined through sampling during the Remedial Investigation.

It is believed that the semi-permeable clay layer separating the shallow zone from the deep zone may contain some TCE residues. This TCE would potentially be slowly released from the semi-permeable clay layer into the deep zone of the aquifer system. It is also possible that the unsaturated zone may contain small amounts of TCE residues, which would be slowly released into the shallow zone of the aquifer system.

Other contaminants, including volatile organics and inorganics, which were constituents of the original waste material, were sporadically detected in the groundwater in the shallow and deep zones, in some instances at concentration levels exceeding federal or state drinking water standards. The most prevalent of these contaminants includes toluene, which is a volatile organic compound (like TCE), and lead and chromium, which are inorganic compounds.

Toluene was detected at concentrations above the NJDEP groundwater quality cleanup criteria of 50 ppb in four deep zone monitoring wells during one sampling round. Concentrations of toluene in these wells during other sampling rounds did not exceed 10 ppb.

Concentrations of lead and chromium, which exceeded the EPA proposed cleanup guideline of 15 ppb for lead, and the NJDEP and EPA drinking water standard of 50 ppb for chromium, were only detected in one shallow zone well and in one deep zone well. The highest concentrations of inorganics were not consistent between sampling rounds per well and appeared to be sporadic. Neither lead nor chromium concentration levels were detected in the groundwater in statistically significant amounts, indicating the lack of contaminant "plumes" of lead and chromium migrating from the Site in the shallow and deep aquifer zones.

Table 1 includes information regarding the concentrations of compounds detected in the groundwater during the Remedial Investigation in comparison to groundwater standards.

Surface water and sediment sampling at three locations along Tar Kiln Branch indicated that lead was present in all three sediment samples and in one water sample. The concentration of lead in the water sample exceeded EPA's Ambient Water Quality Criteria for lead. EPA believes that the Mannheim Avenue Dump Site is not the source of the lead detected in the Tar Kiln Branch because sampling of the shallow groundwater zone (which flows toward Tar Kiln Branch) during the Remedial Investigation did not indicate that lead was migrating from the Site. However, EPA will provide for additional surface water and sediment sampling of the Tar Kiln Branch to assess further, any adverse impact on the Tar Kiln Branch from the Site.

Residential well sampling performed by EPA in 1988 and 1989 indicated that the wells were not impacted by contaminants migrating from the Site. Fourteen residences are located downgradient of the Site. Nine of these residences are downgradient with respect to groundwater flow in the deep zone, and five of these residences are downgradient with respect to groundwater flow in the shallow zone (refer to Figure 4). All of these residences use groundwater from the deep zone as a source of drinking water. Groundwater in the shallow and deep zones has been classified by NJDEP as Class GW-2 groundwater, suitable for potable, industrial or agricultural water supplies.

Potential pathways of migration for volatile organic and inorganic contaminants associated with the Site include volatilization, particulate emission, infiltration through soil to groundwater, and groundwater discharge to surface water bodies such as the Tar Kiln Branch and the Mullica River. Once contaminants enter the water table aquifer (shallow zone), these contaminants are transported in a westerly direction within the shallow zone, and vertically downward through the semi-permeable clay layer, and then into the deep zone where the contaminants are transported in a northeasterly direction. The potential exists for contaminants to migrate from the Site and impact residential wells adversely.

The possible residual TCE contamination in the subsurface soils in the unsaturated zone and in the semi-permeable clay layer separating the shallow zone from the deep zone could potentially provide for the slow release of small amounts of TCE into the shallow and deep zones.

SUMMARY OF SITE RISKS

EPA conducted an Endangerment Assessment (EA) of the "no action" alternative to evaluate the potential risks to human health and the environment associated with the Mannheim Avenue Dump Site in its current state. The EA focused on the groundwater contaminants which are likely to pose the most significant risks to human health and the environment (indicator chemicals). These "indicator chemicals" and their concentrations in the groundwater are shown in Table 2.

EPA's EA identified several potential exposure pathways by which the public may be exposed to contaminants. These pathways and the populations potentially affected are shown in Table 3. The potential exposure routes identified and evaluated in the EA are:

- Dermal contact with contaminated groundwater drawn from wells located downgradient from the Site;
- Ingestion of groundwater from local wells downgradient of the Site;
- Inhalation of chemicals volatilized from groundwater during home use;
- Ingestion of chemicals that have accumulated in fish located in a nearby river; and
- Inhalation of chemicals entering the air as particulates via wind erosion.

The potentially exposed populations include residents and recreational users. Soil sampling indicated that the concentrations of lead in the Site soils were within EPA's health-based cleanup level of 500 to 1000 ppm. Therefore, exposures to Site soils were not considered further in the EA.

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and noncarcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and noncarcinogenic risks associated with exposures to individual indicator compounds were summed to indicate the potential risks associated with the potential carcinogens and noncarcinogens, respectively.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of milligrams per kilogram per day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared with the RfD to derive the hazard quotient for the contaminant in the particular media. The hazard index is obtained by adding the hazard quotients for all compounds across all media. A hazard index greater than 1 indicates that potential exists for noncarcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The reference doses and hazard indices for the indicator chemicals at the Mannheim Avenue Dump Site are presented in Table 4.

The hazard index for noncarcinogenic effects from the Mannheim Avenue Dump site is 5.7×10^{-1} and, therefore, indicates that noncarcinogenic effects are unlikely from the exposure routes evaluated in the EA.

Potential carcinogenic risks were evaluated using the cancer potency factors developed by the EPA for the indicator compounds. Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes the underestimation of the risk highly unlikely. The CPFs for the indicator chemicals and the risk estimates for the site are presented in Table 5.

For known or suspected carcinogens, EPA considers excess upper-bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has one additional chance in ten thousand to one additional chance in a million of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the site. The cumulative upper bound risk at the Mannheim Avenue Dump Site is 4.1×10^{-5}. TCE is present in the groundwater at concentration levels above federal and state drinking water standards (MCLs). EPA has determined that the MCL of 1 ppb for TCE should be met in the groundwater to be protective of human health and the environment.

In summary, risks to public health include the actual or potential risks to residents around the Site. Residents may be impacted primarily through ingestion of potentially contaminated well water, and dermal and inhalation exposures to volatile contaminants in well water while bathing and showering. EPA has determined that actual or potential Site-related risks warrant a remedial action for the Site.

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainty in the exposure assessment is related to the presence of potentially sensitive populations (school children and residents) in very close proximity to the site. Additional uncertainties arise from estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the EA provides upper-bound estimates of the risks to populations near the Site.

For more specific information concerning public health risks, including quantitative evaluation of the degree of risk associated with various exposure pathways, refer to the volume entitled Final Endangerment Assessment for the Mannheim Dump Site located at EPA's information repository at the Atlantic County Library in Galloway Township, New Jersey.

Environmental Risks

The environmental impact from the Site is expected to be low with the exception of groundwater contamination in the immediate vicinity of the Site. The only area potentially impacted by the contaminated groundwater is the surface water and wetland areas associated with the Tar Kiln Branch. The species composition of the area along the Tar Kiln Branch has been classified as a palustrine forested wetland with broad leaved trees. Although lead has been detected in the sediment and water of the Tar Kiln Branch, the environmental impacts associated with its presence are expected to be insignificant. Additional sampling will be performed in the Tar Kiln Branch to assess further, any adverse environmental impacts from the Site. No federally listed or proposed threatened or endangered flora or fauna are known to exist in the vicinity of the Site.

DESCRIPTION OF ALTERNATIVES

Appropriate remedial technologies identified during the screening process of the feasibility study were assembled into combinations to address the remedial action objectives and the goals listed below:

- Prevention of current and future exposure to TCE-contaminated groundwater;
- Protection of uncontaminated portions of the groundwater from being contaminated by preventing the spread of contamination; and
- Restoration of the contaminated groundwater to drinking water standards for future use.

The remedial alternatives that were selected for detailed evaluation are described below.

Alternative 1: No Action with Groundwater Monitoring

Capital Cost:	$ 89,100
Annual Operation and Maintenance (O&M) Costs:	$ 52,600 (years 1 to 5)
	$ 18,600 (years 6 to 30)
Present Worth (PW):	$ 550,100
Time to Implement:	3 months

The No Action alternative is evaluated at every site to establish a baseline for comparison. Under this alternative, no active action would be taken at the Site to prevent migration of, or reduce concentration levels of, TCE in the groundwater. This alternative relies on natural attenuation of contaminants in the groundwater for a reduction of TCE concentration levels to the MCL of 1 ppb.

This alternative includes a long-term monitoring program to assess the migration of contamination in the shallow and deep zones of the aquifer system. This program would use existing monitoring wells, newly installed monitoring wells, and residential wells in the vicinity of the Site. Selected wells would be sampled on a quarterly basis for the first five years, and then bi-annually. This alternative also includes an educational program to inform the public about potential hazards at the Site.

It would take about three months from the issuance of the ROD to begin the implementation of the monitoring program. The reduction in the annual O & M cost after the first five years of monitoring is due to the reduction in frequency of monitoring and the number of parameters analyzed.

The amount of time required for natural attenuation to reduce TCE concentration levels to the MCL is not known at this time because of the uncertainties relating to the presence and degree of residual TCE contamination in the unsaturated zone and in the clay layer separating the shallow zone from the deep zone. The potential exists for this residual contamination to continue to release slowly into the groundwater at an unknown rate and over an unknown period of time.

Alternative 2: Point-of-Use Carbon Adsorption Treatment/Water Use Restrictions

Capital Cost:	$ 147,150
Annual O & M Cost:	$ 52,600 (years 1 to 5)
	$ 50,900 (year 6)
	$ 32,000 (years 7 to 21)
	$ 18,600 (years 22 to 30)
Present Worth:	$ 739,400
Time to Implement:	1 to 3 months to install point of use controls and 12 months for water use restrictions

This alternative includes all of the components of Alternative 1, with the addition of provisions to install and maintain individual carbon adsorption treatment systems on household supplies, if groundwater monitoring (performed on a quarterly basis for the first five years) indicates that the TCE-contaminated groundwater is migrating and threatening the residential wells. The carbon adsorption system would remove TCE to meet the drinking water standard. The treated water would then be used as needed by residents. In addition, this alternative would place restrictions on the installation of any new wells in the contaminated area around the Site. For any new wells installed in the contaminated area, it would be required that treatment units be installed on household supplies before the water is used for potable purposes. For any new or existing wells installed downgradient of the contaminated area, it would be required that treatment units be installed on household supplies, if it were determined that water quality was threatened by TCE contamination. These groundwater use restrictions may, however, be difficult to implement and enforce.

Carbon adsorption treatment units and water use restrictions would be considered for the fourteen existing and potentially six future homes located downgradient from the shallow and deep groundwater zones. The individual treatment systems and the water use restrictions would be temporary and would be in place until groundwater quality had been restored through natural attenuation. The amount of time required for natural attenuation to reduce TCE concentration levels to the MCL is not known at this time because of the uncertainties relating to the presence and degree of residual TCE contamination in the unsaturated zone and in the clay layer separating the shallow zone from the deep zone.

It would take approximately one to three months to install the residential carbon treatment units, once it is determined that residential wells are threatened, and one year to establish water use restrictions.

The annual O & M cost would generally decrease during the 30-year period because the frequency of groundwater monitoring and number of parameters analyzed would decrease with time. The annual cost for years 1 to 5 includes monitoring only. The cost for year 6 includes start-up plus operation and maintenance of the carbon adsorption treatment units (estimated 15 years of use) and reduced monitoring. The annual cost for years 7 to 21 includes operation and maintenance of the treatment units and reduced monitoring. The annual cost for years 22 to 30 includes reduced monitoring.

Alternative 3: Alternate Water Supply/Water Use Restrictions

Capital Cost:	$ 492,100	
Annual O & M Cost:	$ 52,600	(years 1 to 5)
	$ 94,300	(years 6 to 30)
Present Worth:	$ 1,749,200	

Time to Implement: 18 months

This alternative includes all of the components of Alternative 1, with the addition of the development of water supply well(s) and a distribution system to provide potentially affected residences with a continuous source of clean water. The distribution system and capacity of the supply would be sized sufficiently to provide water to the fourteen existing and possibly six future residences that could potentially be affected by TCE contamination. The location of the water supply well(s) would be determined during the design phase of the project and is expected to be placed south of the existing TCE contaminant plumes and at the bottom of the deep groundwater zone (approximately 200 feet below ground surface.) Groundwater would be pumped to a storage or pressurized tank and chlorinated prior to its discharge to the distribution system. Construction of the supply and distribution system would be performed up front, while actual hook-up would not be performed until groundwater monitoring (performed on a quarterly basis for the first five years) indicates that the contamination is migrating and threatening the residential wells.

Groundwater use restrictions would require that all existing and future households be connected to this supply and that residential wells be taken out of service, if groundwater monitoring indicates that contamination is migrating and threatening residential wells. These restrictions, however, may be difficult to implement and enforce.

It would take approximately 18 months to design and construct the new water supply well(s) and connect the residences to this system.

The annual O & M cost for the first five years is associated with groundwater monitoring. Subsequent annual O & M cost would be associated with operation of the new water supply/distribution system and reduced monitoring.

This alternative relies on natural attenuation of contaminants in the groundwater to reduce TCE concentration levels to the MCL. The amount of time required for this natural process is unknown at this time because of the uncertainties relating to the presence and degree of residual TCE contamination in the unsaturated zone and in the clay layer separating the shallow zone from the deep zone.

Alternative 4: Groundwater Pumping/Air Stripping/Reinjection

Capital Cost:	$ 541,000	
Annual O & M Cost:	$ 52,600	(year 1)
	$ 394,100	(years 2 to 5)
	$ 360,100	(years 6 to 17)
	$ 18,600	(years 18 to 30)
Present Worth:	$ 4,217,100	

Time to Implement: 6 to 16 years

This alternative includes the installation of groundwater extraction wells to withdraw the TCE-contaminated water for on-site treatment with discharge through reinjection into the shallow and deep groundwater zones. It was estimated that three extraction wells would be installed in each aquifer zone. Two wells in each zone would be operated continuously and the third would serve as a backup well during periods of well maintenance. It was estimated that six reinjection wells would be installed in each aquifer zone. Three wells in each aquifer would be operated continuously and the additional three wells would serve as backups to be used during maintenance periods. Contaminated water would be pumped from the shallow zone wells and deep zone wells at estimated rates of 10 gallons per minute (gpm) and 40 gpm, respectively. It was assumed that the contaminated extracted groundwater would need to be pretreated to remove iron before being air stripped and discharged to the groundwater. The groundwater extraction and treatment system would be designed to reduce TCE concentration levels to the MCL throughout the area of contamination in the shallow and deep zones and would intercept contamination migrating towards residential wells.

This alternative also includes short-term sampling of downgradient groundwater monitoring wells and residential wells, during the design period, to monitor the potential migration of contaminants towards residential wells. In addition, this alternative includes long-term sampling of downgradient monitoring wells and residential wells, once the system is operational, to monitor the effectiveness of the treatment system in removing contaminants and preventing migration.

The differences in the annual O & M cost over the 30-year period are associated with the differences in the monitoring programs for the residential and monitoring wells and treatment system during that time. The cost for the first year includes monitoring only. The annual cost for years 2 to 5 includes operation and maintenance of the treatment system (estimated 15 years of use) and monitoring. The annual cost for years 6 to 17 includes operation and maintenance of the treatment system and reduced monitoring. The annual cost for years 18 to 30 includes reduced monitoring only.

It is estimated that the groundwater extraction and treatment system can be designed and constructed in approximately 24 months.

The length of time required for this alternative to reduce contamination levels to drinking water standards is approximately six to sixteen years. This time period takes into consideration the influence of the potential residual TCE contamination in the unsaturated zone and in the clay layer.

During the design period, EPA would assess the feasibility and practicality of using infiltration basins as an alternate means of discharging treated groundwater to the underlying shallow aquifer zone.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a detailed analysis of each remedial alternative is conducted with respect to each of nine evaluation criteria. All selected remedies must at least attain the Threshold Criteria. The selected remedy should provide the best trade-offs among the Primary Balancing Criteria. The Modifying Criteria were evaluated following the public comment period.

Threshold Criteria

- Overall Protectiveness of Human Health and the Environment - This criterion evaluates the adequacy of protection that the remedy provides while describing how risks are eliminated, reduced, or controlled through treatment, engineering controls and/or institutional controls.

- Compliance With Applicable or Relevant and Appropriate Requirements (ARARs) - This criterion addresses whether a remedy will meet all of the ARARs of other federal and state environmental statutes and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

- Reduction of Toxicity, Mobility or Volume (TMV) Through Treatment - This criterion addresses the anticipated treatment performance of the remedy.

- Short-Term Effectiveness - This criterion refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment during the remedial action.

- Long-Term Effectiveness and Permanence - This criterion evaluates the magnitude of residual risk and the ability of the remedy to maintain reliable protection of human health and the environment over time once the remedial action has been completed.

- Implementability - This criterion examines the technical and administrative feasibility of executing a remedy, including the availability of materials and services needed to implement the chosen solution.

- Cost - This criterion includes the capital and operation and maintenance costs of the remedy.

Modifying Criteria

- State Acceptance - This criterion indicates whether, based on its review of the Feasibility Study and Proposed Plan, the State of New Jersey concurs with, opposes or has no comment on the preferred alternative.

- Community Acceptance - This criterion evaluates the reaction of the public to the remedial alternatives and EPA's Proposed Plan. Comments received during the public comment period and EPA's responses to those comments are summarized in the Responsiveness Summary attached to this document.

Overall Protection of Human Health and the Environment

Alternative 4 protects public health and the environment because it provides for the removal of TCE contamination from the groundwater in the shallow and deep zones of the aquifer system to meet the drinking water standard, and prevents migration of contamination towards residential wells.

Alternative 1 is not protective of human health and the environment because, along with Alternatives 2 and 3, it would not remove contaminants from the groundwater in the shallow and deep zones of the aquifer system, and thereby allows the migration of contaminants into clean portions of the aquifer. Also, Alternatives 1, 2 and 3 would not prevent the potential contamination of residential wells from migrating TCE.

Alternatives 2 and 3, while not protective of the environment, protect human health because they include treatment units on household supplies and an alternate water supply, respectively, if monitoring indicates the threat of contamination at residential wells. Alternative 2, which provides for individual treatment units on household supplies, would reduce concentration levels of TCE in the groundwater withdrawn from the well to the drinking water standard. Alternative 3 includes an alternate water supply, which would provide affected residents with groundwater in which TCE met the drinking water standard. In addition, Alternatives 2 and 3 include institutional controls to restrict exposure to contaminated groundwater, however, these water use restrictions may be difficult to implement and enforce.

Compliance with ARARs

New Jersey Groundwater Quality Criteria and Maximum Contaminant Levels established pursuant to the Federal and State Safe Drinking Water Acts are applicable federal and state groundwater requirements for this remedial action.

Alternative 4, in actively removing TCE contamination from the groundwater and controlling contaminant migration towards residential wells, satisfies the applicable drinking water standard for TCE, the MCL of 1 ppb. The groundwater collection/ treatment/discharge system provided for under Alternative 4 would be designed to meet the MCL of 1 ppb for TCE in the groundwater in the shallow and deep aquifer zones and at the residential wells. The air stripping would be done in conformance with state and federal air emission standards.

Alternatives 1, 2 and 3 rely on natural attenuation of the TCE contamination in the groundwater to meet the MCL eventually in the shallow and deep zones of the aquifer system through dilution of the volume of contaminants.

Alternatives 2 and 3 meet the ARAR associated with providing safe drinking water to community residents. Alternative 2 accomplishes this by removing the TCE, to meet drinking water standards, from the withdrawn groundwater via treatment units installed on household supplies. Alternative 3 accomplishes this by providing an alternate drinking water supply which meets drinking water standards for TCE.

Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative 4 would reduce the toxicity, mobility and volume of contamination in the shallow and deep zones of the aquifer system by extracting TCE-contaminated groundwater and treating it to meet the drinking water standard of 1 ppb.

Alternatives 1, 2 and 3 do not utilize treatment to reduce the toxicity, mobility or volume of contamination in the shallow and deep aquifer zones. These alternatives would not reduce the mobility of the contaminants in the aquifer, and would rely on natural attenuation, through dilution over time, to reduce the toxicity and volume of contaminants. Alternatives 2 and 3 use treatment via individual carbon adsorption units and an alternative water supply, respectively, to reduce the toxicity and volume of contaminants in the withdrawn groundwater prior to use by residents.

Short-term Effectiveness

Implementation of Alternatives 1, 2, 3 and 4 would not create any adverse short-term impacts on human health and the environment.

The time to achieve protection from contamination in the groundwater in the shallow and deep aquifer zones is shorter for Alternative 4 than for Alternatives 1, 2 and 3. Alternative 4 provides for active removal of the TCE contamination in the shallow and deep aquifer zones. Alternative 4 would include placement of reinjection wells so that no adverse environmental impacts to the nearby surface waters and wetlands would occur.

Alternatives 1, 2 and 3 rely on natural attenuation over time to reduce TCE concentration levels in the groundwater in the shallow and deep aquifer zones to the drinking water standard. The amount of time required for natural attenuation would be influenced by the potential for residual TCE contaminants in the unsaturated zone and in the clay layer to continue to release slowly into the shallow and deep aquifer zones.

Long-term Effectiveness and Permanence

Alternative 4 provides for permanent long-term effectiveness in the protection of human health and the environment over time. Long-term risks to workers during the remedial action do exist through accidental ingestion of the contaminated water or inhalation of air emissions from the air stripper. However, the emissions would be controlled to below the state emission rate for toxic substances. Exposure risks such as these would be mitigated through proper health and safety protection. Air stripping is a well-developed technology which is widely used for removal of volatile organics in groundwater. The treatment system is very reliable but monitoring would be performed to ensure proper operation of the air stripper.

With proper operation and maintenance, Alternatives 2 and 3 would permanently protect individual residents from drinking TCE-contaminated groundwater. However, these alternatives would not prevent contaminants from migrating and adversely affecting clean portions of the groundwater in the shallow and deep aquifer zones.

Alternative 1 does not provide for long-term protection of human health and the environment over time. This alternative does not actively contribute to restoration of the groundwater. Uncontaminated groundwater currently used for drinking purposes may be jeopardized in the future by the spread of contamination.

Implementability

All alternatives are implementable. Alternatives 1, 2 and 3 would involve considerable long-term institutional management. Alternatives 2 and 3 would require the cooperation of local residents and administrative management to operate and maintain the point-of-use treatment systems, and the alternate water supply and distribution system, respectively, as well as the enforcement of water use restrictions. The implementation and enforcement of these restrictions may be difficult. The groundwater monitoring program included as part of each alternative would require some administrative management and cooperation of local residents.

Cost

The total cost includes estimated capital and operation and maintenance costs. The cost comparison for each alternative are shown in Table 6. The present worth costs for each alternative are summarized below.

Alternative 1: Present Worth Cost - $ 550,100
Costs include installation of additional groundwater monitoring wells and 30 years of monitoring.

Alternative 2: Present Worth Cost - $ 739,400
Costs include installation of additional groundwater monitoring wells, installation of individual treatment units (15 years of use), and 30 years of monitoring.

Alternative 3: Present Worth Cost - $ 1,749,200
Costs include installation of additional groundwater monitoring wells, installation of an alternate water supply (25 years of use), and 30 years of monitoring.

Alternative 4: Present Worth Cost - $ 4,217,000
Costs include installation of additional groundwater monitoring wells, installation of groundwater extraction/treatment/discharge system (15 years of use) and 30 years of monitoring.

Depending upon the time for aquifer restoration, either through natural attenuation as with Alternatives 1, 2 and 3, or through active pumping with treatment as with Alternative 4, the costs associated with long-term groundwater monitoring could be significantly reduced.

State Acceptance

The State of New Jersey concurs with the proposed remedial action. The Pinelands Commission has provided comments that have been addressed in the attached Responsiveness Summary.

Community Acceptance

The community was in favor of the preferred remedy. Questions and answers raised during the public meeting are presented in the attached Responsiveness Summary.

SELECTED REMEDY

EPA has evaluated the remedial alternatives in accordance with Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Contingency Plan, and has chosen a remedy for the Mannheim Avenue Dump Site based on the findings of the RI and FS Reports and input by the public.

EPA has selected Alternative 4, groundwater pumping/air stripping/reinjection of the treated water, as the most appropriate remedy for groundwater remediation at the Site.

The major components of this action are as follows:

- Installation and maintenance of a groundwater collection system capable of capturing the TCE contaminant plumes in the shallow and deep aquifer zones.

- Installation and maintenance of an on-site groundwater treatment facility to remove TCE contaminants from the collected groundwater. This facility would consist of an air stripper, with a pretreatment system for iron removal, if necessary.

- Installation and maintenance of reinjection wells to discharge treated groundwater into the shallow and deep aquifer zones. An evaluation of the feasibility and practicality of using infiltration basins in lieu of reinjection wells will be made during the design period.

- Short-term groundwater monitoring, during the design period, to monitor the concentration of contaminants in the groundwater and to assess potential migration of contaminants towards residential wells.

- Long-term groundwater monitoring, once the collection/treatment system is operational, to assess the effectiveness of the system in removing contamination and controlling contaminant migration.

- Contingency planning involving the installation of individual carbon adsorption treatment units at residences, if groundwater monitoring indicates contamination is migrating towards, and threatening, residential wells.

- Surface water and sediment sampling of the Tar Kiln Branch to assess further any impact on the Tar Kiln Branch from the Site.

- Covering of the original waste disposal area with a layer of clean fill to bring the Site up to grade.

The goal of this remedial action is to restore groundwater to its beneficial use. Based on information obtained during the Remedial Investigation and on a careful analysis of all remedial alternatives, EPA believes that the selected remedy will achieve this goal. However, studies suggest that groundwater extraction and treatment are not, in all cases, completely successful in reducing contaminants to federal and/or state drinking water standards in the aquifer. EPA recognizes that operation of the selected extraction and treatment system may indicate the technical impracticability of reaching health-based groundwater quality standards using this approach. If it becomes apparent, during implementation or operation of the system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal, that goal and the remedy may be reevaluated.

The selected remedy will include groundwater extraction for a period of approximately 6 to 16 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include:

- discontinuing operation of extraction wells in areas where cleanup goals have been attained;

- alternating pumping at wells to eliminate stagnation points; and

- pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater.

The evaluation of the groundwater pumping/treatment/reinjection system presented as Alternative 4 was based on the data available in the Remedial Investigation Report regarding the aquifer characteristics at the Site. The data at the Site are limited regarding the intercommunication of the two aquifer zones in question, the precise extent of the TCE contaminant plumes, the potential presence and degree of residual TCE contamination in the unsaturated zone and in the semi-permeable clay layer, and some geochemical parameters. Additional information will be required prior to remedial design concerning the above data limitations, along with pilot testing of the proposed treatment system. Depending on this information, the number of extraction and reinjection wells, the location of these wells, the pumping rates, the time to reduce contaminant levels to drinking water standards, and the costs, as presented under Alternative 4, could be affected.

The following investigations need to be performed:

- Prior to design, further define the extent of TCE contamination in the shallow and deep zones, if possible, down to 1 ppb. This would be accomplished by installing and sampling additional groundwater monitoring wells in the shallow and deep zones.

- Prior to, and during design, construction and operation of the treatment system, monitor the groundwater in the shallow and deep zones for toluene, lead and chromium, which were sporadically detected at concentrations exceeding drinking water and cleanup standards during sampling for the Remedial Investigation. If sampling indicates the wide-spread presence of these contaminants at concentration levels exceeding drinking water and cleanup standards, the groundwater treatment system included in the selected remedy would be modified to address these contaminants.

- Prior to design, sample the unsaturated zone and the semi-permeable clay layer in attempts to identify the potential presence of residual contaminants, which could affect the remediation time frame for the selected alternative.

- Prior to design, conduct groundwater pump tests in the shallow and deep zones to determine aquifer characteristics.

- In the early stages of design, conduct an air pathway analysis to evaluate the need for off-gas controls on the air stripper.

The capital costs for this alternative include installation of additional groundwater monitoring wells and the design and construction of the groundwater pumping/treatment/discharge system. The total estimated capital cost for this alternative is $ 541,000. The estimated annual costs are $52,600 for the first year (for groundwater monitoring), $394,100 for years 2 to 5 (including treatment and monitoring), $360,100 for years 6 to 17 (including treatment and reduced monitoring), and $18,600 for years 18 to 30 (for monitoring only). The total estimate present worth of Alternative 4 is $4,217,100.

Should carbon adsorption treatment units be installed at residential wells as a contingency measure, the capital cost of the selected remedy would increase to $688,150. Annual operation and maintenance costs associated with the individual treatment units would be insignificant in comparison to annual operation and maintenance costs of the groundwater pumping/treatment/discharge system under the selected remedy.

STATUTORY DETERMINATIONS

Protection of Human Health and the Environment

The selected remedy provides for protection of human health and the environment by actively removing TCE contaminants in the shallow and deep aquifer zones to meet the drinking water standard, by preventing the spread of contaminants into uncontaminated portions of the aquifer, and by controlling migration of contamination towards residential wells.
If monitoring indicates that the contaminated groundwater is threatening residential wells, either during the design period or after the collection/treatment/discharge system is operational, the contingency to provide residences with individual carbon adsorption treatment units would become effective.

Implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts.

Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy complies with applicable or relevant and appropriate requirements. This remedy would serve to reduce TCE contamination in the groundwater to the applicable drinking water standard, which is the MCL established under the New Jersey Safe Drinking Water Act. Air stripping will be done in conformance with New Jersey State and Federal air emission standards. Any sludge produced from treatment of groundwater would be handled according to New Jersey State Sludge Quality Criteria Guidelines and Federal Hazardous Materials Transportation Act. Discharge of treated groundwater will be done in conformance with the New Jersey State Pollutant Discharge Eliminantion System and with Federal Safe Drinking Water Act underground injection standards. RCRA 40 CFR Parts 261 to 264 and 268 Standards would be met. In addition, the selected remedy would satisfy provisions of the Federal Wetlands Executive Order, the Wild and Scenic River Act, and the Coastal Zone Management Act. The selected remedy would also satisfy provisions of the New Jersey Coastal Area Facilities Review Act, Rules and Coastal Resources and Development Act, New Jersey Wild and Scenic Rivers Act, and Freshwater Wetlands Protection Act Rules.

Cost-Effectiveness

After evaluating all of the alternatives which most effectively address the principal threat posed by the contamination at the Site, EPA has concluded that the selected remedy is cost-effective in that it affords overall effectiveness proportionate to its costs.

Utilization of Permanent Solutions and Alternative Treatment (or resource recovery) Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable.

The selected remedy provides the best balance of trade-offs among the alternatives with respect to the evaluation criteria. The selected remedy provides for the most long-term effectiveness and permanence of the alternatives. The selected remedy provides for the most reduction of toxicity, mobility and volume of TCE contaminants through treatment than the other alternatives, which rely on natural attenuation to reduce TCE concentration levels in the aquifer. The air stripper is expected to remove greater than 98 percent of the TCE from the groundwater. Mobility of contaminants would not be reduced under the other alternatives. The selected remedy provides for the restoration of the contaminated groundwater to the drinking water standard for TCE in a faster time frame than the other alternatives. The selected remedy is implementable and is the most cost-effective of the alternatives.

The selected remedy was preferred over the other alternatives by the community members, who favored an alternative that would restore groundwater quality in the shortest time frame and prevent the spread of contaminants towards residential wells.

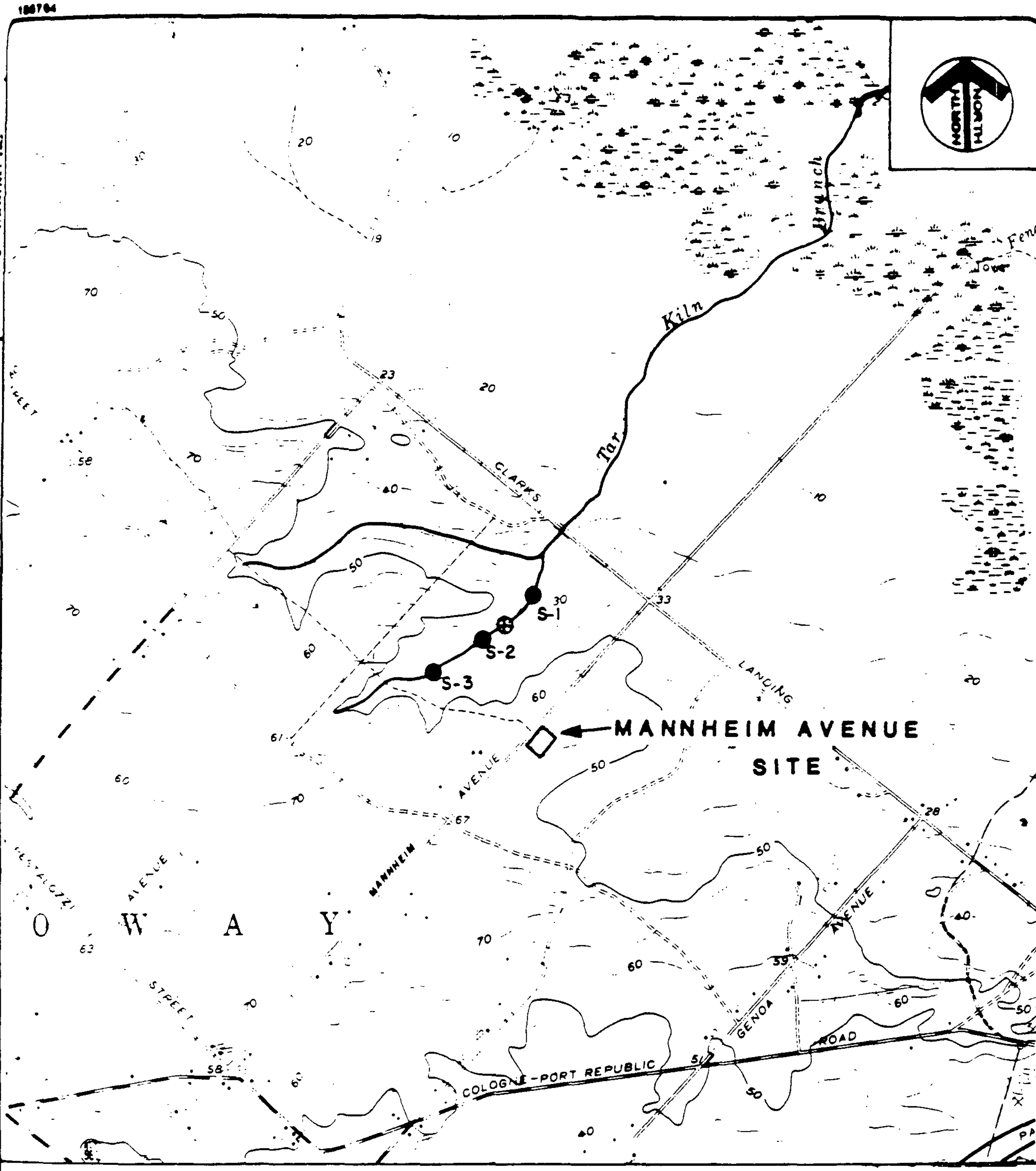
The selected remedy meets the statutory requirement to utilize permanent solutions and treatment technologies to the maximum extent practicable.

Preference for Treatment as a Principal Element

The statutory preference for treatment as a principal element is satisfied in the selected remedy. The selected remedy includes air-stripping of the extracted TCE-contaminated groundwater which would treat the groundwater to the drinking water standard.

Documentation of Significant Changes

The public expressed concern over the possibility of TCE contaminants migrating and adversely impacting residential wells before the implementation of the groundwater pumping/ treatment/discharge system. In response to this concern, EPA will monitor the migration of the contaminants in the groundwater (including sampling residential wells) during the design period prior to implementation of the groundwater treatment system. EPA will also monitor the groundwater once the treatment system is operational. If monitoring indicates that the contaminants are migrating and threatening residential well water quality (on an individual basis), EPA will provide for the installation of individual carbon adsorption treatment units, as a contingency measure. These treatment units would remove TCE contaminants from the groundwater to meet drinking water standards. The water could then be used as needed by the residents.



⊕ APPROXIMATE LOCATION OF APRIL 16, 1986 SAMPLING POINT

● S-1 APPROXIMATE LOCATION AND DESIGNATION OF MAY 9, 1990 SAMPLING POINTS

SCALE 0 2000FT

GERAGHTY & MILLER, INC. Environmental Services

LOCATION MAP, Mannheim Avenue Site, Galloway Township, New Jersey

FIGURE 1

000059

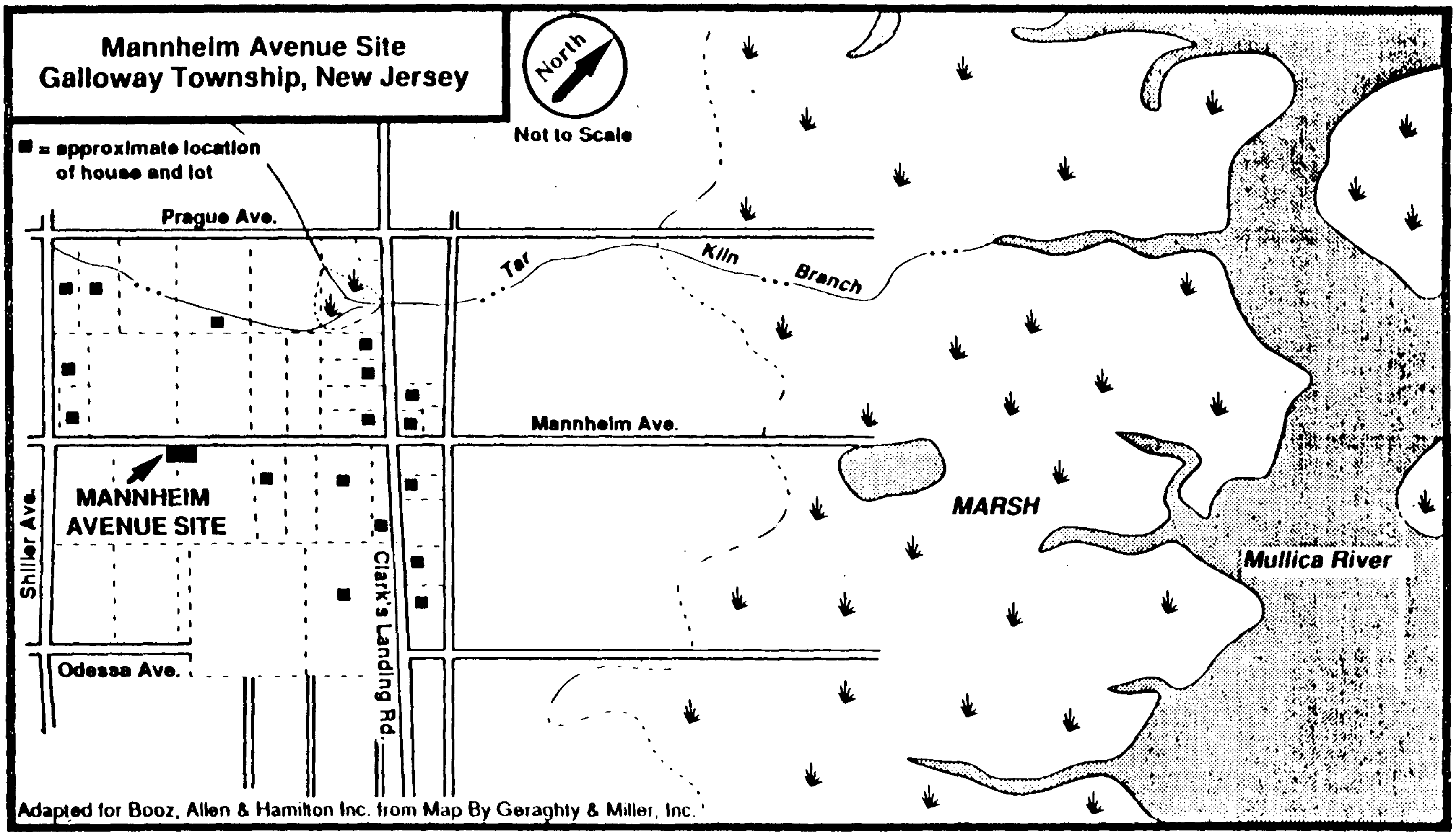


Figure 2

0G590

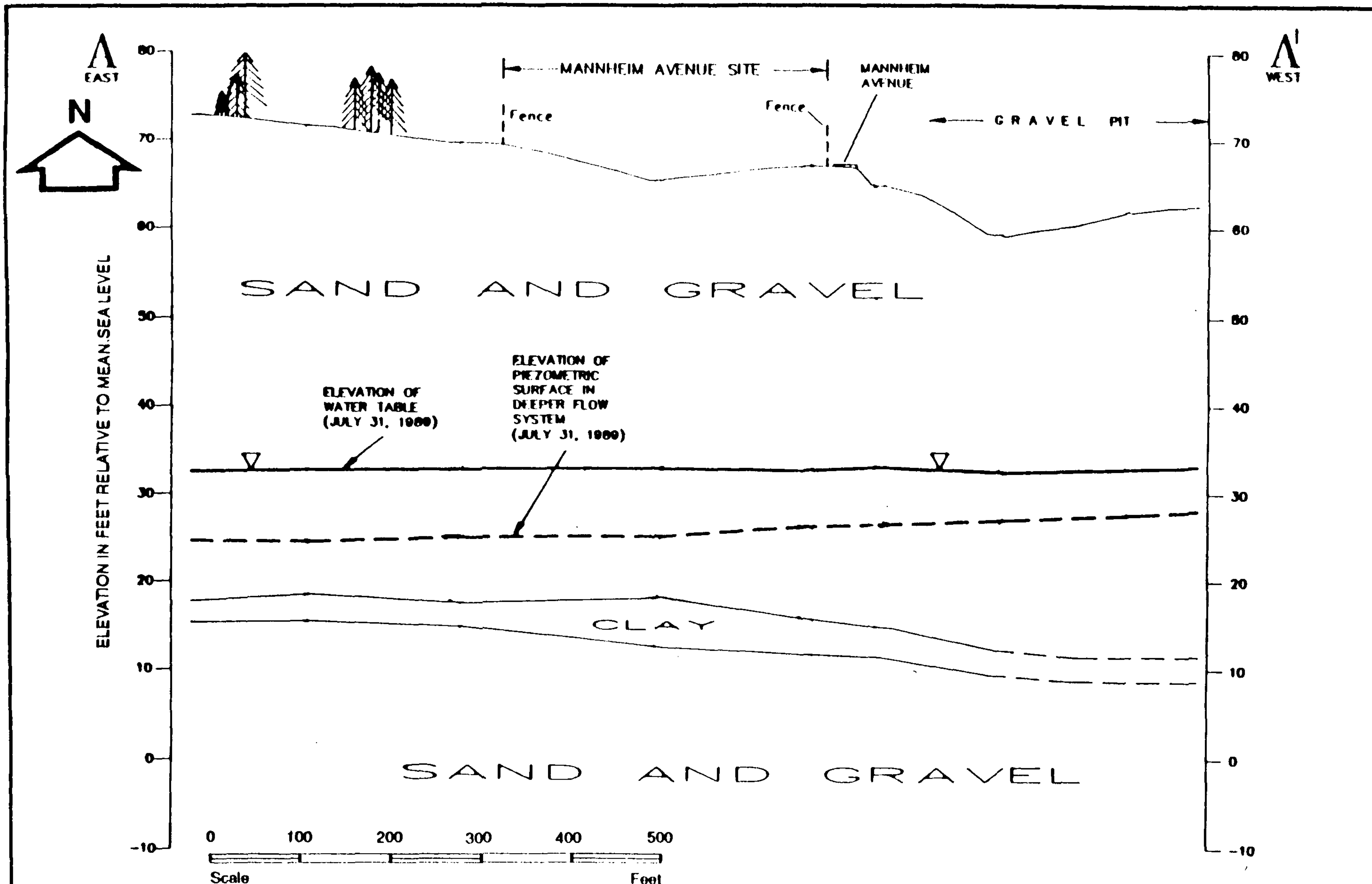
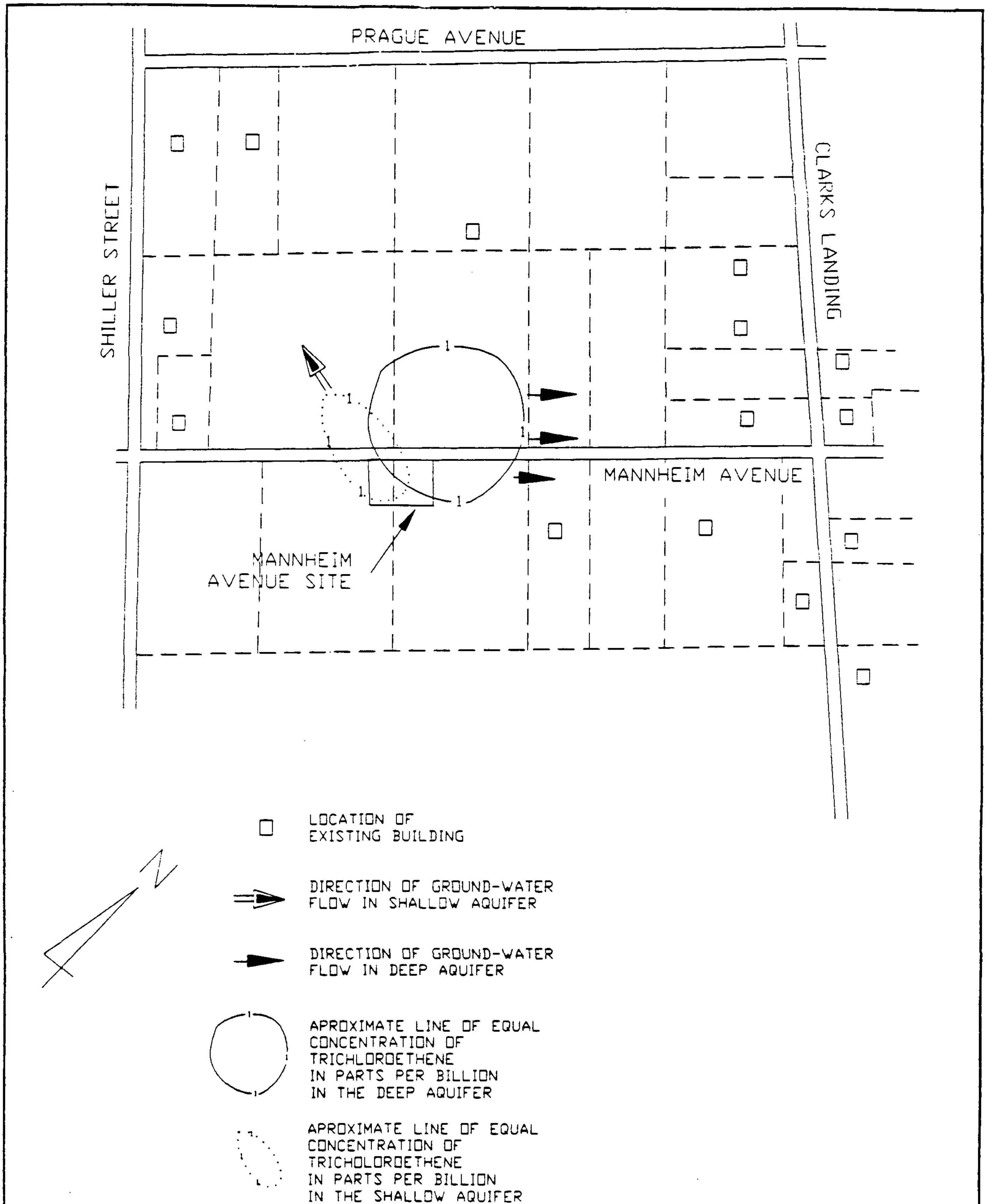


Figure 3

CDM - Federal Programs Corporation

Hydrogeologic Cross Section A-A1

Mannheim Avenue Site, Galloway Township, New Jersey



MANNHEIM AVENUE DUMP GALLOWAY TOWNSHIP, NEW JERSEY	**EXTENT OF TRICHLOROETHENE IN DEEP AND SHALLOW AQUIFER**	Figure **4** 9/90

TABLE 1

GROUND WATER CONTAMINANTS COMPARISON TO STANDARDS
MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

Compound	No. of occurence / No. of samples	Range (ppb)	Standard (ppb)	No. of samples above standard	Percent above standard
Benzene	3/65	0.1 J - 1.9	1.0[1]	1	1.5
Ethylbenzene	7/65	0.2 J - 17	700 (MCL proposed-EPA)	0	0
Methylene chloride	7/65	0.45 - 12	2[1]	4	6.2
Toluene	25/65	0.2 J - 300 J	50[2]	5	7.7
Trichloroethene	49/65	1 - 47	1[1]	49	75
Arsenic	7/60	1 - 5.4 J	50[1]	0	0
Barium	14/14	19.6 - 110	1000[1]	0	0
Beryllium	9/60	0.5 - 101 J	0.0037[3]	9	15
Cadmium	7/60	3.5 - 7	10[1]	0	0
Chromium	34/60	5.7 - 359	50[1]	4	6.7
Iron	14/14	379 - 15,200	300[4]	14	100
Lead	48/60	1.6 - 342	15[6]	4	6.7
Manganese	14/14	13.9 - 1,209	50[4]	4	28
Nickel	3/60	19.8 - 54.6	15.4[5]	3	5
Thallium	2/48	2 - 2	17.8[5]	0	0

TABLE 1 (continued)

1. New Jersey Safe Drinking Water Act MCL
2. NJDEP Groundwater Quality Clean-up Criteria
3. NJPDES toxic effluent limitations for protection of potable water
4. Secondary Drinking Water Standard (Federal Safe Drinking Water Act)
5. EPA Ambient Water Quality Criteria for the Protection of Human Health
6. EPA Proposed Clean-Up Guideline

* Includes duplicates as individual samples and includes both data collected by G&M and splits by FPC during 1989.

TABLE 2*

SUMMARY STATISTICS OF UNFILTERED GROUND WATER DATA[1]

	(#Occurences)/ (# of Samples)	Concentration Range (ppb)	Appropriate Standard (ug/L)	Number of Exceedences	Arith/Geo Mean (ppb)
Metals					
Arsenic	6/32	0.05-6.7	50[2]	-	2.14/0.94
Berylium	4/32	0.5-3.4	NA	-	1.7/1.3
Cadmium	4/32	4.7-7.0	10[2]	-	5.73/5.65
Chromium	20/32	5.5-359	50[2]	3	36.89/13.89
Copper	29/32	3.7-124	1,000[3]	-	14.15/8.74
Lead	29/32	1.15-342**	15[10]	3	17.74/5.28
Mercury	3/32	0.24-1.0	2[2]	-	0.58/0.49
Nickel	2/32	28.5-54.6	15.4[4]	2	41.55/39.45
Selenium	5/32	2.0	10[2]	-	2/2
Thallium	2/32	2.0	17.8[4]	-	2/2
Zinc	32/32	5.45-124	5,000[3]	-	22.54/16.86
Volatile Organic Compounds					
Chloroform	28/32	0.5-5.65	100[8]	-	2.12/1.91
cis 1,2 dichloroethane	4/32	0.5-1.3	70[7]	-	1.01/0.95
ethylbenzene	3/32	0.55-2.7	700[6] (proposed)	-	1.48/1.21
methylene chloride	2/32	9.15-11	2[9]	-	10.08/10.03
toluene	8/32	1.0-200	2,000[7]	-	63.36/20.41
trichloroethylene	27/32	1.0-47	1.0[9]	26	12.65/7.39
o,m,p-xylenes	4/32	0.9-12.0	44[9]	-	5.78-4.08

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1. Each well sampled on two different dates; replicates not included in this column; estimates disregarded
2. Primary Drinking Water Standard. Source 40CFR Part 265, Appendix III
3. Secondary Drinking Water Standard. Source 40CFR Part 143.3
4. EPA Ambient Water Quality Criteria for the Protection of Human Health
5. U.S. Public Health Service Potable Water Standards
6. Safe Drinking Water Act MCLs
7. Safe Drinking Water Act MCLGs
8. Currently Regulated Under Total Trihalomethanes (U.S. EPA Drinking Water Hotline)
9. New Jersey Safe Drinking Water Act MCLs
10. EPA Proposed Clean-Up Guideline

* This table has been updated from Table 1-10 in the Endangerment Assessment Report for the Mannheim Avenue Dump Site, prepared by CDM Federal Programs Corporation, dated July, 1990

** The value of 342 ppb replaces the previously reported value of 85,600 ppb.

(IV 28/22)

TABLE 3
SUMMARY OF COMPLETE EXPOSURE PATHWAYS
AT THE MANNHEIM AVENUE SITE FOR
CURRENT AND FUTURE LAND USE

Potentially Exposed Population	Exposure Route, Medium, and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Residents	Dermal contact with contaminated ground water drawn from wells located down-gradient from the site.	Yes	Residents employ ground water from wells for domestic use.
Residents	Ingestion of ground water from local wells down-gradient of the site.	Yes	Residents use ground water from wells as drinking water.
Residents	Inhalation of chemcals volatilized from ground water during home use.	Yes	Some of the chemicals of potential concern in ground water are volatile, and ground water is used by local residents.
Residents Recreational Users	Ingestion of chemicals that have accumulated in fish located in a nearby river.	Yes	Lead in site soils might reach the river via storm runoff. Intakes calculated but no risks quantified because USEPA has not reach a final decision on RfDs, slope factors.
Residents	Inhalation of chemicals entering the air as particulates via wind erosion.	Yes	Lead in site soils might expose residents via air. Intakes assessed but risks not quantified because USEPA has not reached a final decision on RfDs, slope factors.

TABLE 3 CONT'D.
SUMMARY OF COMPLETE EXPOSURE PATHWAYS
AT THE MANNHEIM AVENUE SITE FOR
CURRENT AND FUTURE LAND USE

Potentially Exposed Population	Exposure Route, Medium, and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Residents Workers	Direct contact with chemicals of potential concern in soil on the site.	No	Lead in site soil may be absorbed by children and workers. Lead in soils is within USEPA clean up goal.
Residents Workers	Inadvertent ingestion of potentially contaminated soil on the site.	No	Lead in site soil may be ingested by children and workers. Lead in soils is within USEPA clean up goal.

Note: This site is currently owned by a municipality. The adjacent area is developed for limited residential use. The future use of this property is identified as residential for the purposes of this endangerment assessment.

Table 4

CALCULATION OF CHRONIC HAZARD INDICES
ASSUMING TRIVALENT CHROMIUM
AND USING THE IRIS DATABASE
MANNHEIM DUMP SITE

Chemical	Total Oral/Dermal CDI (mg/kg/day)	Acceptable Intake RfDo (mg/kg/day)$^{-1}$	Oral/Dermal Ratio CDI:RfDo
Cadmium	2.66E-04	5.00E-04	5.32E-01
Chromium III	2.00E-03	1.00E+00	2.00E-03
Copper	1.32E-03	(a)	-
Lead	8.81E-04	(b)	-
Mercury	1.38E-05	(c)	-
Nickel	1.52E-03	(d)	-
Zinc	2.65E-03	(d)	-
Chloroform	2.91E-04	1.00E-02	2.91E-02
cis 1,2 dichloroethene	9.40E-05	(a)	-
Toluene	2.84E-03	3.00E-01	9.47E-03
Trichloroethene	1.25E-03	(c)	-
Mixed Xylenes	1.33E-04	2.00E+00	6.65E-05
HAZARD INDEX			5.73E-01

Notes:
(a) RfDo not available
(b) EPA has deemed that an RfDo may be inappropriate for inorganic lead
(c) Under review by EPA at this time
(d) Not found in IRIS
The absorption was assumed to be 100% for administered doses where appropriate.
CDI is defined as the chronic daily intake in units of mg/kg/day.
Oral/Dermal refers to the sum of the CDIs for the ingestion and dermal pathways.
RfDo is defined as the oral reference dose.

Table 5

MANNHEIM DUMP SITE
RISK ESTIMATES FOR CARCINOGENS
BY EXPOSURE PATHWAY
USING THE IRIS DATABASE

ORAL/DERMAL PATHWAY

Chemical	Water Ingestion CDI (mg/kg/day)	Dermal Absoption CDI (mg/kg/day)	Oral Slope Factor $(mg/kg/day)^{-1}$	Total Chemical-Specific Risk
Chloroform	1.24E-04	3.90E-07	6.10E-03	7.59E-07
Trichloroethene	5.35E-04	1.68E-06	1.10E-02	5.90E-06

INHALATION PATHWAY

Chemical	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor $(mg/kg/day)^{-1}$	Total Chemical-Specific Risk
Chloroform	2.23E-04	8.10E-02	1.81E-05
Trichloroethene	9.60E-04	1.70E-02	1.63E-05

TOTAL RISK

Chemical	Oral/Dermal Chemical-Specific Risk	Inhalation Chemical-Specific Risk	Total Chemical-Specific Risk
Chloroform	7.59E-07	1.81E-05	1.88E-05
Trichloroethene	5.90E-06	1.63E-05	2.22E-05

TOTAL CALCULATED RISK FOR THIS SITE 4.10E-05

Notes:

CDI is defined as the chronic daily intake in units of mg/kg/day.
Oral/Dermal refers to the sum of the ingestion and dermal pathways.
The oral and inhalation slope factors reported for Trichloroethene were taken from the Health Effects Assessment Summary Tables for the first and second quarters of 1990 (HEAST, 1990).

TABLE 6

COST SUMMARY TABLE FOR REMEDIAL ALTERNATIVES

Remedial Alternatives for Groundwater	Capital Costs	Annual Operation and Maintenance Costs	Total Present Worth
Alternative 1 - No Action/Monitoring	89,100	52,600 (years 1-5) 18,600 (years 5-30)	550,100
Alternative 2 - Point-of Use Carbon Adsorption Treatment/ Water Use Restrictions	147,150	52,600 (years 1-5) 50,900 (year 6) 32,000 (years 7-21) 18,600 (years 22-30)	739,400
Alternative 3 - Alternate Water Supply/ Water Use Restrictions	492,100	52,600 (years 1-5) 94,300 (years 6-30)	1,749,200
Alternative 4 - Groundwater Pumping/Air Stripping/Reinjection	541,000	52,600 (year 1) 394,100 (years 2-5) 360,100 (years 6-17) 18,600 (years 18-30)	4,217,100

RESPONSIVENESS SUMMARY

RECORD OF DECISION

MANNHEIM AVENUE DUMP SITE

I. Introduction

The Mannheim Avenue Dump site is located in a two-acre sand and gravel clearing on Mannheim Avenue in Galloway Township. Originally, the site, which is owned by Galloway Township, was mined for sand and gravel for the construction of township roads. During the mid-1960s, Lenox China, a potentially responsible party for the site, disposed of waste materials in the excavated portion of the property. The site was placed on the National Priorities List of uncontrolled hazardous waste sites in 1983. Lenox China removed the waste materials from the site in 1985, under an administrative order issued by the U.S. Environmental Protection Agency (EPA), and conducted a Remedial Investigation and Feasibility Study (RI/FS) at the site, under an administrative consent order issued by EPA in May 1988.

In accordance with EPA's community relations policy and guidance, and the public participation requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, the EPA Region II office established a public comment period from July 17, 1990 to August 15, 1990, to obtain comments on the Proposed Plan for the Mannheim Avenue Dump site.

On August 7, 1990, EPA held a public meeting to receive public comments on the proposed remedy. Approximately 20 community residents and interested persons attended the meeting. Copies of the Proposed Plan were distributed at the meeting and placed in the information repositories for the site.

The Responsiveness Summary, required by the Superfund Law, provides a summary of citizens' comments and concerns identified and received during the public comment period, and EPA's responses to those comments and concerns. Section II of this document presents a summary of the significant questions and comments expressed by the public, either verbally during the public meeting or in writing, concerning the proposed remedy selection. Section III of this document presents a summary of the significant questions and comments concerning the proposed remedy selection, submitted in writing by Eder Associates Consulting Engineers (Eder), on behalf of Lenox, Inc., and The Pinelands Commission. Each question or comment is followed by EPA's response. All comments expressed to EPA were considered in EPA's final decision for selecting the remedial alternative for addressing the groundwater contamination.

Attached to this Responsiveness Summary are four appendices. Appendix A includes all written comments received during the comment period. Appendix B contains the Proposed Plan for the remedy. Appendix C contains the sign-in sheet of attendees at the August 7, 1990 public meeting. Appendix D contains the public notice issued to the Atlantic City Press, printed July 17, 1990, announcing the public comment period and availability of the Remedial Investigation and Feasibility Study and Proposed Plan for public review.

II. Summary of Community Comments and EPA Responses

This section contains verbal and written questions and comments received from the community during the public comment period. Comments contained in this section are grouped according to the subject discussed.

A. Proposed Plan and Future Site Actions

1. **A resident asked how the proposed remedy would control the spread of the plume, and where wells would be placed to control the spread of contamination.**

   EPA Response: The extraction well system will be designed to control the spread of the plume and to capture the contaminated groundwater. The extraction wells would be placed in specific areas to withdraw the contaminated water from both the shallow and deep aquifer zones, as effectively and efficiently as possible, thereby minimizing the intake of clean water. Before determining the number and placement of extraction and reinjection wells and the pumping rates for each well, additional tests will be conducted. It is anticipated that groundwater would be reinjected downgradient of the contaminant plume in the shallow zone in an area which will not affect the Tar Kiln Branch. In the deep zone, it is anticipated that treated groundwater would be reinjected into areas upgradient of the deep zone contaminant plume.

2. **A resident asked how fast the contaminant plume is spreading, what effect the weather would have upon the spread of the plume, and what effect the reinjection of water into the aquifers would have upon the effectiveness of the proposed treatment system. The resident also requested that another test be conducted, so there would be a second reference point for evaluating the spread of the plume over time.**

   EPA Response: The groundwater flow rate within the shallow zone is approximately 0.6 feet per day; and in the deep zone, approximately 1.4 feet per day. The contaminants in the two aquifer zones do not necessarily flow at the same rate as the groundwater. It is not known at this time the rate at which the contaminants move within the aquifer zones. Weather would not have a significant effect on the spread of the contamination. It is possible that excessive rainfall could create a small amount of dilution and spreading of the contaminants in the shallow zone. With respect to the effect reinjection of treated water into the aquifer zones would have upon the proposed treatment system, the reinjection wells would be placed in a location so as not to interfere with the extraction wells' withdrawal of contaminated groundwater. Additional groundwater sampling will be performed to evaluate the spread of the contaminant plume over time.

3. **A resident was concerned about the possibility of site contaminants reaching residential wells prior to site cleanup, and if preventive measures could be taken.**

   EPA Response: Yes, preventive measures can be taken. Such measures may not be necessary, however, because the groundwater remediation system would be designed to prevent the spread of contamination. Residential wells would be monitored for contaminants both before and during the operation of the groundwater remediation system. In addition, monitoring wells will be installed between the residences and the site. Monitoring the groundwater would enable EPA to determine whether the contamination is spreading to the homes. In addition, EPA will be sampling homes within the next few months, and will continue to sample them periodically throughout the design phase to ensure that the contamination is not threatening residential wells. EPA has added a contingency plan to the selected remedy in the Record of Decision (ROD), to provide residences with individual carbon adsorption treatment units, if it appears that the contamination is spreading and threatening these residences.

4. **Another area resident asked about the estimated time frame for State acceptance of the Proposed Plan, EPA selection of the final remedy, and the implementation of the final remedy.**

   EPA Response: EPA has conferred with the New Jersey Department of Environmental Protection (NJDEP) regarding the Proposed Plan and provided the Department with a draft copy of the ROD. The NJDEP concurs with the proposed remedial action. Regarding the time frame for implementation of the final remedy, EPA estimates that the groundwater remediation system will be operational in approximately twenty-four to thirty months from issuance of the ROD. This time will be spent negotiating with the potentially responsible parties to design and implement the selected remedy, conduct pre-design field work, and design and construct the groundwater remediation system.

5. **Several residents made the comment that they agreed with the selection of Alternative Four for cleaning up the site.**

   EPA Response: EPA thanked the residents for their support of the proposed remedial action.

6. **A local resident whose well had been tested asked where the plume of contamination was flowing. In addition, the resident asked whether charcoal filters used in home treatment devices are similar to the carbon adsorption treatment systems included under Alternative 2, as described in the Proposed Plan.**

   EPA Response: In the shallow zone of the aquifer system, the groundwater contaminant plume flows in a northwesterly direction, towards the Tar Kiln Branch. In the deep zone, the groundwater contaminant plume flows in a northeasterly direction, towards the Mullica River.

   Charcoal filters are used to improve the aesthetic quality of the water, namely, the taste and odor. Also, in theory, charcoal filters may remove some volatile organics, if maintained properly. Such filters would not be effective in removing trichloroethene (TCE) contamination from the water down to the drinking water standard of 1 part per billion (ppb). The carbon adsorption treatment systems presented under Alternative 2 would remove all of the TCE in the water down to the level of 1 ppb. EPA has added the use of carbon adsorption treatment units to the selected remedy, as a contingency measure, if monitoring indicates that contaminated groundwater is migrating towards, and threatening, residential wells.

7. **An area resident asked why the contamination in the deep aquifer zone appears to be migrating towards the opposite side of Mannheim Avenue from where the site is located.**

   EPA Response: Contaminants originating in the waste at the site first entered the site soils, and then migrated into the shallow aquifer zone beneath the site. Once in the shallow zone, contaminants were transported away from the site in a northwesterly direction. Due to the downward gradient across the shallow and deep zones, contaminants in the shallow zone were then transported vertically downward through the semi-confining clay layer, and then into the deep zone, where the contaminants were transported in a northeasterly direction according to the flow pattern. Contaminants in the deep zone which are present on the opposite side of Mannheim Avenue from the site could have originated in the groundwater flowing in the shallow zone, across the street from the site, before entering the deep zone. It should be noted, however, that the highest concentration of TCE contaminants in the deep zone was detected in a monitoring well located north of the site, on the same side of Mannheim Avenue as the site.

8. **A resident who attended the public meeting provided EPA with written comments regarding the proposed remedial alternative. In the comments, the resident commented that the width of the deeper aquifer plume is directly related to the length of the shallow aquifer plume, since the two aquifers are connected through the semi-permeable, 3-to-5 foot clay layer. As the shallow plume moves to the Tar Kiln Branch, the deeper plume will expand simultaneously in the same direction, on its way to the Mullica River. The resident further noted that this posed a potential threat to more wells than stated at the meeting and that time is of the essence to implement Alternative #4.**

   The resident also requested in his letter that EPA use a three-dimensional flow model to get a better understanding of the change in size and concentration levels of the contamination plume over time. He added that measurements taken at both existing and additional wells over a period of time, will help in determining the modeling coefficients. The retardation coefficient in the flow model should be a variable, not a constant, that changes with the concentration level. Example: 1 for < 1 ppb and > 2 for > 10 ppb.

   EPA Response: A three-dimensional flow model will be developed during the design phase. Additional investigations to be performed prior to design will provide the data to be used in the flow model.

B. **General Comments**

1. **A resident who lived near the site commented that trash (such as carpets and wallboard) is being dumped in an area behind the site, outside the fence surrounding the site. The resident asked whether the access road around the site could be barricaded, and whether the fence could be taken down and the site revegetated and regraded. The resident added that EPA should consider taking such action in its Proposed Plan.**

   EPA Response: It appears that the illegal dumping is occurring on property owned by the township. EPA advised the resident to contact the township for resolution of this matter. Regarding the access road and the fence, EPA cannot barricade the road nor remove the fence at this time. The site has not been totally cleaned up yet, and portions of the treatment system may need to be located within the fenced area. Regrading the site is part of the selected remedy.

2. **An attendee at the public meeting noted in his written comments to EPA that Alternative 2 in the FS refers to "Point-of-Use" carbon filters, although it actually describes "Point-of-Entry" carbon filters. A point-of-use filter is attached to the drinking supply at the point-of-use, in this case, a faucet. He commented that Alternative 2 should be implemented on an interim basis (i.e., 1-3 years) until Alternative 4 is operational.**

   EPA Response: The carbon adsorption treatment units included under Alternative 2 are actually "point-of-entry" devices, which would be installed in the home to serve the entire household supply. The Selected Remedy includes the installation of these treatment units, if contamination were migrating towards, and threatening residential wells, either during design or operation of the groundwater remediation system.

3. **One local resident who attended the public meeting wrote to EPA asking when his water would be retested. He commented that the meeting on August 7 was good and that he was anticipating the implementation of Alternative 4. The resident also asked whether he could build on two lots next to his house without restrictions.**

   EPA Response: EPA is planning to sample select residential and groundwater monitoring wells in October or November of 1990. Regarding whether the resident could build on two lots next to his house, the resident should inquire about any restrictions at the township, county and state offices, especially regarding the installation of residential drinking water wells.

III. <u>Summary of Comments from Other Interested Parties and EPA Responses</u>

This section contains written questions and comments received from Lenox Inc., the potentially responsible party, and The Pinelands Commission.

A. Comments from Lenox, Inc.

Eder Associates (Eder), a consultant to Lenox, Inc., reviewed the Feasibility Study Report (FS) prepared by EPA's contractor and raised issues concerning the development and evaluation of the remedial alternatives presented in the FS, as discussed below.

1. **Eder agrees with the FS statement that one remedial action objective is to protect uncontaminated groundwater. Eder does not believe that the FS presents the technical justification to support the conclusion that a pump and treat system will remediate the aquifer to the 1 ppb level for trichloroethene (TCE). Eder noted that the FS alternatives are based on modeling done to determine whether it would be possible to achieve a 5.0 ppb TCE concentration in the aquifer.**

   The FS and the EPA's Record of Decision (ROD) should recognize that a remedial action objective is a goal and that there are implementability and effectiveness constraints in remediating an aquifer to a 1.0 ppb TCE concentration.

   The ROD must indicate the practical limitations of a pump and treat remedy in achieving a 1.0 ppb TCE groundwater cleanup goal in accord with EPA Directive 9355.4-03.

   EPA Response: The alternatives in the FS are based on modeling the cleanup of the TCE contaminant plumes in the shallow and deep zones of the aquifer system as defined by concentrations of at least 5.0 ppb. It was not possible to predict the extent of the contaminant plumes and the rate of cleanup at a level of 1.0 ppb TCE (the MCL) because insufficient chemical distribution and hydrogeologic data were available for levels of contamination less than 5.0 ppb. As discussed in the FS report, additional monitoring wells are proposed as part of remedial design to define more precisely, the vertical and horizontal extent of contamination and to aid in the design of the groundwater remediation system. With the help of groundwater modeling, the most efficient groundwater extraction/injection system can be developed and the amount of time required to restore the aquifer can be better estimated.

   As with all remedial actions, the effectiveness of the selected remedy will be monitored through periodic groundwater sampling and an evaluation of the system will be performed at least every five years, as required by the Superfund Amendments and Reauthorization Act (SARA). Cleanup goals, contingency plans, operational changes, and other site-specific factors will be revisited during these evaluations and appropriate modifications will be made. Any proposed changes, especially proposing less stringent cleanup goals, would require significant documentation and analysis to support taking such actions. It should be noted that the Record of Decision does discuss the uncertainties and technical limitations of the selected remedy in achieving the MCL of 1 ppb for TCE in the shallow and deep zones of the aquifer system.

2. **The FS (page 2-24) states that "The Pinelands Commission prohibits the discharge of wastewater to surface water bodies or to infiltration basins unless injection to the aquifer via wells is not technically feasible." This statement is incorrect. The Commission's regulations allow recharge to an aquifer using leaching galleries or retention basins. As a result of this erroneous interpretation of the Commission's regulations, the remedial alternatives developed in the FS rely on injection wells as the discharge option for treated groundwater. In general, injection wells are more costly to install and maintain than leaching systems. Moreover, injection wells are more susceptible to natural fouling than leaching systems and EPA's remedies include pretreatment to remove iron to minimize the impact of this fouling. This pretreatment step and associated costs may not be required, if leaching is employed as opposed to injection wells. Eder has developed pump and treat alternatives assuming recharge through leaching galleries. The costs associated with these alternatives are presented in Appendix A of this document.**

   EPA Response: The FS report incorrectly states that infiltration basins are prohibited by the Pinelands Commission. However, the Proposed Plan that was presented at the site public meeting stated that the feasibility and practicality of using infiltration basins in lieu of reinjection wells will be evaluated during the design period. The same holds true for the ROD. Although infiltration basins may be used for some of the treated groundwater, they may not be appropriate for the entire flow. The determination as to whether infiltration basins, reinjection wells, or a combination of both, would be most efficient to use for groundwater recharge, will be made during subsequent remedial design activities. Impacts on the water table and the wetlands area, and the number and spacing of the infiltration basins are of critical concern when evaluating this option. Because of the uncertainties involved, the costs cited in the FS are considered to be conservative estimates; the actual cost of the remedial action will be further defined during the upcoming remedial design.

   The FS qualified the need for pretreatment to remove iron prior to reinjection because additional information on inorganics concentrations is needed before EPA can decide whether pretreatment will actually be part of the final remedy. Again, the suitability of infiltration basins for discharging treated groundwater and the need for metals removal prior to reinjection of treated water will be determined during remedial design. It should be noted that infiltration basins do clog and will require some maintenance.

3. **Eder suggests that only limited effort be expended in further plume delineation at the 1 ppb TCE level (two or three additional monitoring wells) and further investigation of the unsaturated zone and clay layer. Eder believes that this additional information would not materially contribute to the remedial design in any meaningful way.**

   EPA Response: Additional investigations to determine if significant concentrations of TCE are present in the unsaturated zone and the semi-permeable clay between the shallow and deep aquifer zones were proposed in the FS to determine if potential residual contamination could significantly impact remediation of the groundwater. Although little action could be taken to enhance the removal of potential contaminants within the clay layer, various ways to recharge treated groundwater may enhance the removal of potential contaminants from the vadose zone; this could possibly reduce the amount of time required to meet the site cleanup objectives. Additional investigations were also proposed to define further the vertical and horizontal extent of TCE contamination. The extent of these investigations will be determined prior to design of the groundwater remediation system.

4. **The FS states that the extraction rate of 50 gallons per minute (gpm) was selected to remediate the shallow and deep zones of the aquifer to a 5 ppb TCE concentration, rather than to the 1 ppb TCE concentration goal, because of limited site data at lower TCE concentrations. Therefore, the remedial alternatives (4A and 4B) presented in the FS are based on remediating the aquifer to a 5 ppb concentration.**

   The FS states that the MCL of 1 ppb would be achieved, apparently based upon the evaluation of achieving 5 ppb by pumping and treating groundwater. Eder believes that the ROD must recognize that 1 ppb is a goal that may not be achievable and changes in the pumping rates and/or the remedial goal may be required.

   EPA Response: Please refer to the discussion in response to Comment 1 above.

5. **EPA's design influent TCE concentration to the GAC treatment unit is stated as 50 ppm (p. 3-24), while the actual concentration is 50 ppb. Regardless of whether this is a typographical error, Eder believes that the carbon usage rate in the GAC component of Alternative 4B is grossly overstated and in turn has a significant impact on the operation and maintenance (O&M) and present worth costs of the GAC alternative. Eder carbon usage estimates were developed in conjunction with Calgon Corp. based on field experience and not from theoretical calculation. Using usage rates**

calculated by Eder and supported by Calgon, Eder believes that the cost effectiveness criteria is satisfied and this alternative should be carried through the FS detailed analysis of alternatives.

EPA Response: The influent TCE concentration to the GAC treatment unit is 50 ppb; 50 ppm was a typographical error. The Freudlich Isotherm Equation was used in the FS to determine the size and expected time until exhaustion of a GAC contactor to be used to remove low levels of TCE. Other conservative assumptions were used to calculate carbon usage to compensate for the uncertainties in the design based on isotherm data. The following discusses the two approaches presented by Eder for developing carbon usage and compares how the approaches presented in the FS differ. The first approach presented by Eder uses isotherm data, while the second uses an estimated usage rate provided by carbon manufacturers.

When performing isotherm calculations in the first method, it is first necessary to select isotherm data, the equilibrium concentration, and an engineering safety factor. The isotherm data selected for the FS were developed by Dobbs and Cohen of EPA and are presently considered to be conservative. Eder selected less conservative isotherm data. Isotherm data presented in the literature vary widely; therefore, computed usage rates can vary widely. For the FS, the effluent concentration was conservatively selected for use in the isotherm calculation, whereas Eder selected the less conservative influent concentration. When TCE breakthrough occurs in the GAC bed (when the carbon will be replaced), the top of the bed will be in equilibrium at the influent concentration, while the bottom of the bed will be in equilibrium with the effluent concentration. Depending on the depth of the adsorption wavefront, the actual usage rate theoretically will fall somewhere between the usage rate computed using the influent concentration and that computed using the effluent concentration. Since there is little data available on the depth of adsorption wavefronts and since TCE is relatively difficult to adsorb, the FS used the conservative method of predicting usage rates with isotherms. Lastly, an engineering safety factor of four was used in the FS to account for the uncertainty regarding design with isotherm data, whereas Eder used no safety factor.

The second method of projecting GAC usage presented by Eder was predicated on the manufacturer's estimated usage rate based on field experience. This calculation resulted in a more conservative estimate than the first method using isotherm calculations and was, therefore, selected for use in Eder's calculation of operating costs. However, no safety factor was included for the uncertainties associated with actual influent concentrations, other components in the ground water that may exhaust GAC, or imperfect operation of the treatment system. A safety factor must be included in all remedies to ensure the continued, effective operation of the remedy.

If GAC were selected as the remedy, testing of the actual water stream is typically recommended as part of design to provide reliable design data.

6. **Eder believes that Alternatives 4A and 4B, which specify iron removal using precipitation and filtration, grossly overestimate the volume of sludge, because EPA's calculations are based solely on backwash volume of a commercial unit without regard to influent solids. Eder's calculations, based upon site conditions, show that less than 40 gallons per day of iron sludge at a solids concentration of 1% would be generated. These calculations are included in Appendix A.**

   In addition, Eder feels that the iron removal system (precipitation and filtration), presented and included in the remedial cost estimates in the FS, may not be necessary if leaching in lieu of injection wells is incorporated into the design. If chemical treatment is utilized, sequestering iron rather than precipitating it as a sludge may be more suitable. Eder believes that the FS and the ROD should indicate that the iron removal component in any pump and treat alternative must be established during the design phase and not as a ROD stipulation.

   EPA Response: The FS states that the need for iron removal will have to be further evaluated in the design phase, since limited data were available when preparing the FS. However, based on these limited data, the inclusion of an iron removal system for both the injection well and the recharge basin (leaching gallery) alternatives is justified. Precipitated iron can clog the soil in the vicinity of either system, resulting in a decrease in recharge transmissivity.

   Again, the estimate presented in the FS is conservative. The disposal volume could be reduced through further treatment of the low-concentration sludge.

   In computing the projected sludge production rate, Eder only took into account the iron hydroxide component of the sludge. They did not consider other contributing components such as the added polymer or turbidity which may be found in the water and may be co-precipitated in the sludge. Furthermore, the calculations in Eder's comments do not factor in the possibility of increased sludge production from an increase in iron concentration or from imperfect operation of the treatment system.

Eder states that if chemical treatment is utilized, it may be more suitable to sequester iron rather than precipitate it as a sludge. It may be difficult, however, to select an acceptable sequestering agent. For example, phosphates are common sequestering agents used in drinking water treatment. However, their use can promote biological growth, especially in basins exposed to sunlight, which could clog the basins. Other sequestering chemicals are generally not acceptable for use in drinking water treatment. Use of these agents may be of concern to The Pinelands Commission.

7. **Eder believes that the O&M costs presented in the FS appendix conflict with the text, and the monitoring and treatment duration presented in the appendix also conflicts with the text. A review of Eder's cost estimates summarized in Table 1 (included in Appendix A of this document) reveals that the selected alternative present worth cost estimated by EPA at $4.2 million, is more reasonably estimated at approximately $1.6 million, if <u>all</u> alternatives were evaluated utilizing more realistic cost and performance data.**

   EPA Response: The present worth calculations are correct and the treatment durations (numbers of years of treatment and monitoring) are correctly presented. On Table B-4 in the appendix, the number of years of treatment are correctly presented but the calendar years are incorrect. Instead of treating from years 5 to 20, the report should read "years 2 to 17."

   To further address the comment, refer to the responses to Comments 2, 5 and 6 provided above. The costs presented in the FS are conservative. Additional information obtained during the design phase will further optimize the treatment and reinjection schemes, which will allow EPA to develop more refined cost estimates.

8. **The FS contains certain design details such as equipment size, construction materials and treatment system configurations. Eder recognizes that this information was used to evaluate the cost of the FS alternatives. However, Eder would like the FS and the ROD to indicate that the selected remedy is based on a conceptual design and that it is subject to change during the remedial design phase.**

   EPA Response: The selected remedy is based on a conceptual design. This conceptual design is subject to change during the remedial design phase. The final design of the remedial action will be developed after additional information is obtained.

B. Comments from The Pinelands Commission

Written comments were received from The Pinelands Commission on March 26, 1990 and August 15, 1990 regarding the proposed remedial alternative. EPA's response letter is included in Appendix A. The Commission made the following comments:

1. The water quality standards of the New Jersey Pinelands Comprehensive Management Plan (CMP) require that no development be permitted which degrades surface or ground water quality. Although the water quality standards of the CMP do not identify specific limits for the contaminant TCE detected in the groundwater at the site, the nondegradation standard should be applied to any proposed remediation.

   The preferred alternative, groundwater pumping/air stripping/reinjection is generally acceptable to the Commission. However, the proposal to treat contaminated groundwater to meet drinking water standards (1 ppb for TCE) is not acceptable. The Commission believes that this proposal would not comply with the nondegradation standard of the CMP which, along with the Pinelands Protection Act of 1979 and the National Parks and Recreation Act of 1978 qualify as applicable or relevant and appropriate requirements (ARARs). Therefore, the proposed remedial action plan should be amended to set a treatment level of nondetect for the contaminant of concern.

   EPA Response: EPA's proposed cleanup action should not be considered new development which may degrade water quality in the Pinelands. Rather, the groundwater in the aquifer underlying the Site is contaminated as a result of improper hazardous waste disposal. By extracting and treating this groundwater, the water quality will be significantly improved. For this reason, EPA does not believe that the nondegradation objective of the Pinelands CMP is an applicable requirement.

   In addition, the groundwater underlying the Site has been classified by the New Jersey Department of Environmental Protection (NJDEP) as Class GW II. Accordingly, drinking water standards, or Maximum Contaminant Levels (MCLs) established under the New Jersey Safe Drinking Water Act, N.J.A.C. 7:10-16.7, are the applicable cleanup standards for the Site. The MCL established for TCE is 1 part per billion (ppb).

2. The Commission received a copy of the comments prepared by the New Jersey Department of Environmental Protection (NJDEP) for the Remedial Investigation, the Feasibility Study and the Proposed Plan. It appeared to the Commission that several of the comments raise substantive and procedural issues with regard to the investigation and proposed remediation. The

Commission requested that EPA address all the issues raised within their comments, and stated that it would object to any Record of Decision which does not address the concerns raised in NJDEP's comments.

EPA Response: EPA is attempting to resolve these matters with the Department.

APPENDIX A

Herman Lindeboom
Consulting Services
507 Clark's Landing Rd
Egg Harbor, N.J. 08215
Tel: 609-965-7230

Ms Laura Lombardo
Project Manager
U.S. Environmental Protection Agency-Region II
Emergency and Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278

Date: August 11, 1990

Dear Ms Lombardo,

As was stated at the Public Meeting in Mays Landing concerning the Mannheim Ave Superfund Site of August 7, I feel #4 would be the best remedial choice.

Observations

After reviewing the Data in the Mannheim Ave Superfund Site File at the Atlantic County Library, it became apparent that the width of the deeper aquifer Plume is directly related to the length of the sallow aquifer Plume, since the two aquifers are connected through the semi-permeable 3 to 5 feet clay layer.
As the shallow Plume moves to the Tar Kiln Branch, the deeper Plume will expand simultaneously in the same direction, on its way to the Mulica river.
Thus posing a potential threat to more wells than stated at the meeting.
In other words time is of the essence to start Alternative #4.

To get a better feel for the change in size and concentration levels of the Plumes over time, a three dimensional Flow Model is desirable, coupling the shallow and deeper aquifers,while measurements over time of existing and added wells will help in determining the modeling coefficients.
The retardation coefficient in the Flow Model should be a variable, not a constant, that changes with the concentration level. Example: 1 for < 1 PPB and > 2 for > 10 PPB.

Yours truly,

Mannheim Avenue Superfund Site
Public Meeting Response Card
August 7, 1990

Name: Mrs. Margaret Poehner

Address: 247 N. Odessa Avenue

City: Egg Harbor State: NJ Zip: 08215

x Please add my name to the mailing list. (I think I'm already on it

— Please respond to the following question/comment. (Include name and address to receive a response.)

Question/Comment: I just want you to know that I appreciate the work being done to safeguard our water supply/property values/environment and I also appreciate being kept informed as steps are taken to correct this situation. It is good for local residents to be involved in working with government and not just have government do things without asking. Thank you.

Mannheim Avenue Superfund Site
Public Meeting Response Card
August 7, 1990

Name: JOSEPH J. KANE, SR

Address: 358 N. MANNHEIM AVE

City: EGG HARBOR State: NJ Zip: 08215

X Please add my name to the mailing list.

X Please respond to the following question/comment. (Include name and address to receive a response.) *

Question/Comment: * • MY WATER TESTED IN MAR. 1989 – WHEN WILL EPA TEST IT AGAIN?

• GOOD PRESENTATION ON AUGUST 7, 1990 –

• CAN'T WAIT FOR IMPLEMENTATION OF ALTERNATIVE #2, MY TWO LOTS NEXT TO

* { MY HOME ARE READY FOR BUILDING ~~[illegible]~~ (CAN I BUILD WITHOUT RESTRICTIONS?) (MY 20 ACRES HAVE BEEN SUBDIVIDED INTO 3 LOTS)

SINCERELY J. J. Kane 8/7/90

002587

Mannheim Avenue Superfund Site
Public Meeting Response Card
August 7, 1990

Name: CHARLES H. HARRIS

Address: 2 BALA PLAZA Suite 300

City: BALA CYNWYD State: PA Zip: 19004

✓ Please add my name to the mailing list.

✓ Please respond to the following question/comment. (Include name and address to receive a response.)

Question/Comment: ALT 2 IN your FS Refers to "Point of USE" Carbon Filters. you have actually described "Point of Entry" Carbon Filters. A point of use Filter is attached to the drinking supply at point of use. It seems to me that Alternative 2 should be implemented on an interim basis ie 1-3 years until ALT 4 is operational This will ensure water safety at minimal cost

000588

FEDERAL EXPRESS
OVERNIGHT DELIVERY

eder associates
consulting engineers, p. c.

August 14, 1990
File #532-2

Laura Lombardo
Remedial Project Manager
Emergency & Remedial Response Division
United States Environmental
Protection Agency
26 Federal Plaza, Room 720
New York, New York 10278

Re: Mannheim Avenue Site
Galloway Township, New Jersey

Dear Ms. Lombardo:

On behalf of Lenox Inc, Eder Associates (EA) has reviewed the Feasibility Study (FS) prepared by EPA's contractor, CDM - Federal Programs Corporation. We have identified certain errors in the development and evaluation of the remedial alternatives presented in the FS and would like to make the following comments:

1. The FS states that one remedial action objective (RAO) is to protect uncontaminated groundwater. We concur with this remedial action objective. The FS claims that pump and treat Alternatives 4A and 4B will prevent plume migration and restore the aquifer to the 1 ppb TCE MCL (refer to Table 2, page 3-21, 3-23, 4-29 and 4-30). The FS does not present the technical justification to support the conclusion that a pump and treat system will remediate the aquifer to the 1 ppb TCE MCL. In fact, the FS alternatives are based on modeling done to determine whether it would be possible to achieve a 5.0 ppb TCE concentration in the aquifer.

   The FS and the EPA's Record of Decision (ROD) should recognize that an RAO is a goal and that there are implementability and effectiveness constraints in remediating an aquifer to a 1.0 ppb TCE concentration. This was recognized and discussed on pages 52 and 53 in Eder Associates June 1990 Feasibility Study (copy attached).

   The ROD must indicate the practical limitations of a pump and treat remedy in achieving a 1.0 ppb TCE groundwater cleanup goal in accord with USEPA Directive 9355.4-03 which states:

   > <u>Recommendation 2</u>: Provide flexibility in the selected remedy to modify the system based on information gained during its operation.

Continued . . .

85 FOREST AVENUE, LOCUST VALLEY, NEW YORK 11560 • (516) 671-8440
8000 EXCELSIOR DRIVE, SUITE 302, MADISON, WISCONSIN 53717-1914 • (608) 836-1500
315 W. HURON STREET, SUITE 220/240, ANN ARBOR, MICHIGAN 48104 • (313) 663-2144
5210 GORGE ROAD, CAZENOVIA, NEW YORK 13035 • (315) 655-3179

> In many cases, it may not be possible to determine the ultimate concentration reductions achievable in groundwater until the groundwater extraction system has been implemented and monitored for some period of time. RODs should indicate the uncertainty associated with achieving cleanup goals in the groundwater.
>
> In general, RODs should indicate that the goal of the action is to return the groundwater to its beneficial uses: health based levels should be achieved for groundwater that is potentially drinkable. In some cases, the uncertainty in the ability of the remedy to achieve this goal will be low enough that the final remedy can be specified without a contingency. However, in many cases, it may not be practicable to attain that goal, and thus it may appropriate to provide in the ROD for a contingent remedy, or for the possibility that this may only be an interim ROD. Specifically, the ROD should address the possibility that information gained during the implementation of the remedy may reveal that it is technically impracticable to achieve health based concentrations throughout the area of attainment, and that another remedy or contingent remedy may be needed.

Moreover, p. 6 of this Directive states, in part:

> If it is determined that some portion of the ground water within the area of attainment cannot be returned to its beneficial uses, an evaluation of an alternate goal for the ground water should be made.

2. The FS (Page 2-24) states that "the Pinelands Commission prohibits the discharge of wastewater to surface water bodies or to infiltration basins unless injection into the aquifer via wells is not technically feasible". This statement is incorrect. The Commission's regulations allow recharge to an aquifer using leaching galleries or retention basins. As a result of this erroneous interpretation of the Commission's regulations, the remedial alternatives developed in the FS rely on injection wells as the discharge option for treated groundwater. In general, injection wells are more costly to install and maintain than leaching systems. Moreover, injection wells are more susceptible to natural fouling than leaching systems and EPA's remedies include pretreatment to remove iron to minimize the impact of this fouling. This pretreatment step and associated costs may not be required if leaching is employed as opposed to injection wells.

Continued . . .

EA has developed pump and treat alternatives assuming recharge through leaching galleries. The costs associated with these alternatives are presented and discussed in Comment No. 5 below.

3. The FS states that additional investigations of the vadose zone and the clay between the shallow and deeper aquifers and detailed determinations of the extent of plume migration are required. In fact, it would be virtually impossible to identify the impact of small quantities of TCE released from a few drums that may have leaked at various times over the site. Moreover, this additional information would not materially contribute to the remedial design in any meaningful way. In addition, the FS requires that detailed determinations be performed to define the extent of the groundwater plume at 1.0 ppb TCE concentrations. These determinations and investigations are not defined. We suggest that only limited effort be expended in these areas which would include the addition of two or three monitoring wells.

4. The pump and treat alternatives (4A and 4B) are based on an extraction rate of 50 gpm. Information presented in Appendix C of the FS states that this flow rate was selected to remediate the aquifers to a 5.0 ppb TCE concentration because of limited site data at lower TCE concentrations. Therefore, the remedial alternatives presented in the FS are based on remediating the aquifers to a 5 ppb concentration.

   The FS states that the MCL (1 ppb) would be achieved, apparently based upon the evaluation of achieving 5 ppb by pumping and treating groundwater. Although the RAO is 1.0 ppb, we trust all parties understand that pump and treat alternatives may not achieve this goal. Consequently, the ROD must recognize that 1.0 ppb is a goal that may not be achievable and changes in the pumping rates and/or the remedial goal may be required.

5. In addition to the above comments, EA has found certain significant errors in the cost calculations presented in the FS. The revisions to the FS remedial alternatives required to address the above and correction of the errors will materially change the capital and O&M cost estimates. EA has prepared the attached tables detailing more representative remedial alternative costs. The key elements of changes/corrections are as follows:

Continued . . .

Laura Lombardo
United States Environmental
Protection Agency
August 14, 1990

a. Alternatives 4A and 4B wrongly assume that injection wells must be used to recharge groundwater based on an incorrect interpretation of Pinelands Commission regulations. Consequently, we have added Alternatives 4A-1 and 4B-1 which include leaching rather than injection wells.

b. EPA's design influent TCE concentration to the GAC treatment unit is stated as 50 ppm (p. 3-24), while the actual concentration is 50 ppb. Regardless of whether this is a typographical error, the carbon usage rate in the GAC component of Alternative 4B is grossly overstated and in turn has a significant impact on the O & M and present worth costs of the GAC alternative. EA carbon usage estimates were developed in conjunction with Calgon Corp based on field experience and not from theoretical calculation. Using usage rates calculated by EA and supported by Calgon, the cost effectiveness criteria is satisfied and this alternative should be carried through the FS detailed analysis of alternatives.

c. Alternatives 4A and 4B which specify iron removal using precipitation and filtration grossly overestimate the volume of sludge because EPA's calculations are based solely on backwash volume of a commercial unit without regard to influent solids. It is absolutely unjustified to assume that sludge volume has no relationship to the content of the influent. EA's calculations based upon site conditions, show that less than 40 gallons per day of iron sludge at a solids concentration of 1% would be generated. These calculations are attached.

   In addition, the iron removal system (precipitation and filtration) presented and included in the remedial cost estimates in the FS may not be necessary if leaching in lieu of injection wells is incorporated into the design. If chemical treatment is utilized, sequestering iron rather than precipitating it as a sludge may be more suitable. The FS and the ROD should indicate that the iron removal component in any pump and treat alternative must be established during the design phase and not as a ROD stipulation.

d. The O&M costs presented in the FS appendix conflict with the text, and the monitoring and treatment duration presented in the appendix also conflicts with the text.

Continued . . .

A review of EA's cost estimates summarized in Table 1 reveals that the selected alternative present worth cost estimated by EPA at $4.2, is more reasonably estimated at approximately $1.6 million, if all alternatives were evaluated utilizing more realistic cost and performance data.

6. The FS contains certain design details such as equipment size, construction materials and treatment system configurations. We recognize that this information was used to evaluate the cost of the FS alternatives. However, the FS and the ROD must indicate that the selected remedy is based on a conceptual design and that it is subject to change during the remedial design phase.

In summary, the ROD should reflect that:

- the RAO of 1.0 ppb TCE is a goal and in fact may not be attainable;

- leaching as a discharge option should be evaluated in the design phase (together with other numerous design level details set forth in the FS);

- the $4.2 million present worth cost for the selected remedial alternative is overstated and that a more reasonable present worth cost estimate is $1.6 million; and

- any additional studies/investigations be limited to only those necessary to support the remedial design and further definition of the plume.

We trust that EPA will address these comments during its remedy selection and that this letter will be incorporated into the administrative record. We are available to meet with EPA and its consultant to review these issues.

Very truly yours,

EDER ASSOCIATES CONSULTING ENGINEERS, P.C.

Gary A. Rozmus, P.E.
Vice President

GAR/tg

cc: S. Lichtenstein
J. Kinkela
A. Gustray
G. Berman

#0580G

MANNHEIN AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

PRELIMINARY IRON SLUDGE CALCULATIONS

Assume: Fe Concentration 2.7 mg/l
Iron Sludge is 50% (Wt) Fe
Sludge @ 1% solilds
Flowrate = 50 gpm

lbs/d Fe = 2.7 mg/l x 8.3 x 50 gal/min x 1440 min/d x mg/10^6

Fe = 1.6 lbs/d

$$\text{Iron Sludge} = \frac{1.6 \text{ lbs/d}}{50\%} = 3.2 \text{ lbs/d}$$

$$\text{Sludge Volume} = \frac{3.2 \text{ lbs/d}}{(0.01)\ 8.3 \text{ lbs/gal}} = 39 \text{ gal/d}$$

MANNHEIM AVENUE SITE

GALLOWAY TOWNSHIP, NEW JERSEY

PRELIMINARY GAC CALCULATIONS

Influent Concentration = 50 ppb

Effluent Concentration = 1 ppb

Flow = 50 gpm

a. From TCE Isotherm (Calgon Corporation)

@ 50 ppb:

$$\frac{10\ \text{mg TCE}}{\text{g carbon}} = \frac{0.01\ \text{lb TCE}}{\text{lb carbon}}$$

$$\frac{\text{lb TCE}}{\text{day}} = \frac{50\ \text{gal}}{\text{min}} \times \frac{(50-1)\ \text{ug}}{1} \times \frac{10^{-6}\text{g}}{\text{ug}} \times \frac{3.781}{\text{gal}} \times \frac{\text{lb}}{454\text{g}} \times \frac{1{,}440\ \text{min}}{\text{day}}$$

$$= 0.03\ \text{lb/day}$$

Carbon Required:

$$\frac{\text{lb Carbon}}{\text{day}} = \frac{0.03}{0.01} = 3\ \text{lb/day}$$ (0.04 lb carbon/1,000 gal water)

Yearly

Carbon Required = 3 x 365 = 1,100 lb/yr

b. Per Calgon

Need < 0.1 lb carbon/1,000 gal water

@ 50 gpm (72,000 gal/day)

Carbon = 0.1 x 72 = 7.2 lb/day
= 2,630 lb/yr

Assume 4000 lb/yr

Summary of Remedial Alternative Cost Estimates
Mannheim Avenue Site
Galloway Township, New Jersey

	Alternative 4A	Alternative 4A-1	Alternative 4B	Alternative 4B-1
Total Capital Cost	$541,300	$416,800	$613,800	$495,200
O&M Costs				
Years				
0-5 (Monitoring)	$52,605	$52,605	$52,605	$52,605
6-30 (Monitoring)	$18,585	$18,585	$18,585	$18,585
2-17 (Groundwater Recovery and Treatment)	$100,900	$77,000	$92,000	$80,800
Present Worth of O&M *	$1,385,000	$1,159,000	$1,301,000	$1,187,000
Total Alternative Cost	$1,926,300	$1,575,800	$1,914,800	$1,682,200

Notes:

*Present worth of monitoring and groundwater recovery and treatment

Alternative 4A: CDM's Alternative - Pump and treat by air stripping, recharge by injection wells - costs reflect revised iron sludge generation rate.

Alternative 4A-1: Pump and treat by air stripping, recharge by leaching galleries, no iron removal.

Alternative 4B: CDM's Alternative - Pump and treat by GAC, recharge by injection wells - costs reflect revised iron sludge and spent carbon generation rates.

Alternative 4B-1: Pump and treat by GAC, recharge by leaching galleries, no iron removal - costs reflect revised spent carbon generation rate.

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 1
TABLE B-4 (CDM)

ALTERNATIVE 4A: GROUNDWATER PUMPING/AIR STRIPPING/ON-SITE DISCHARGE
CAPITAL COST ESTIMATES (1990 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
I. PUBLIC AWARENESS PROGRAM	1	Included in Installation		5,000.00	5,000.00	5,000.00
II. MONITORING WELLS						
a. Shallow	1	Included in Installation		3,500.00	3,500.00	3,500.00
b. Intermediate	5	Included in Installation		7,000.00	35,000.00	35,000.00
c. Deep	3	Included in Installation		7,500.00	22,500.00	22,500.00
						61,000.00
III. SITE PREPARATION						
1. Equipment Foundation	93 cy	Included in Installation		450.00	41,850.00	41,850.00
2. Equipment Storage Area	1	Included in Installation		8,000.00	8,000.00	8,000.00
						49,850.00
IV. PUMPING WELL AND COLLECTION SYSTEM						
1. Well (upper aquifer)	3 ea	Included in Installation		3,500.00	10,500.00	10,500.00
2. Well (lower aquifer)	3 ea	Included in Installation		9,200.00	27,600.00	27,600.00
3. Well Pump (upper aquifer)	3 ea	500.00	1,500.00	100.00	300.00	1,800.00
4. Well Pump (lower aquifer)	3 ea	600.00	1,800.00	100.00	300.00	2,100.00
5. Piping:						
a. 2 inch PVC	2,200 lf	Included in Installation		3.56	7,832.00	7,832.00
b. Trenching	2,200 lf	Included in Installation		1.40	3,080.00	3,080.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						53,912.00
V. EQUALIZATION & CHEMICAL FEED						
1. Equalization Tank	1	Included in Installation		4,000.00	4,000.00	4,000.00
2. Chemical Feed System:						
a. Polymer	1 ea	Included in Installation		1,600.00	1,600.00	1,600.00
b. Chemicals	2 ea	Included in Installation		600.00	1,200.00	1,200.00
c. Chlorine	1 ea	Included in Installation		600.00	600.00	600.00
						7,400.00
VI. AIR STRIPPER	1	16,000.00	16,000.00	4,000.00	4,000.00	20,000.00

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
VII. PRESSURE FILTER						
1. Static Mixer	1	Included in Installation		400.00	400.00	400.00
2. Multi-Media Pressure Filter	1	Included in Installation		9,000.00	9,000.00	9,000.00
3. Backwash Waste Tank	1	Included in Installation		6,000.00	6,000.00	6,000.00
4. Supernatant Pump	1	400.00	400.00	100.00	100.00	500.00
5. Clearwell Tank	1	Included in Installation		6,000.00	6,000.00	6,000.00
						21,900.00
VIII. REINJECTION WELLS						
1. Well (upper aquifer)	6 ea	Included in Installation		3,500.00	21,000.00	21,000.00
2. Well (lower aquifer)	6 ea	Included in Installation		9,200.00	55,200.00	55,200.00
3. Well Discharge Pump	1 ea	450.00	450.00	100.00	100.00	550.00
4. Piping:						
a. 2 inch PVC	9,000 lf	Included in Installation		3.56	32,040.00	32,040.00
b. Trenching	4,500 lf	Included in Installation		1.40	6,300.00	6,300.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						116,090.00
IX. TREATMENT SYSTEM PIPING & VALVES						
a. 2 inch PVC	200 lf	Included in Installation		3.56	712.00	712.00
b. Valves	30 ea	Included in Installation		65.00	1,950.00	1,950.00
						2,662.00
X. INSTRUMENTATION AND CONTROLS	LS			10,000.00		10,000.00
XI. ELECTRICAL	LS	Included in Installation		25,500.00		25,500.00

Total Direct Cost (TDC)	373,314
Contingency @20% of TDC	74,663
Engineering @20% of TDC	74,663
Legal and Administrative @5% of TDC	18,666
TOTAL CONSTRUCTION COST	541,300

Key

lf = linear feet
LS = lump sum
sy = square yard

Note: Alternative 4A: CDM's Alternative - Pump and treat by air stripping, recharge by injection wells - costs reflect revised iron sludge generation rate.

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 2
TABLE B-4 (CDM)

ALTERNATIVE 4A: GROUNDWATER PUMPING/
AIR STRIPPING/ON-SITE DISCHARGE

ANNUAL OPERATION AND MAINTENANCE COST ESTIMATES (1990 DOLLARS)

COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
1. Site Monitoring (0-5 years) (See O&M for Alternative 1)		52,605	0-5
2. Site Monitoring (5-30 years) (See O&M for Alternative 1)		18,585	5-30
TREATMENT O&M COSTS			
3. Chemicals			
a. Polymer	438 lbs 2.00/lb	$876	2-17
			2-17
b. H2SO4	4,406 lbs 0.50/lb	$2,203	2-17
c. NaOH	8,424 lbs 0.84 lb	$7,076	2-17
d. Chlorine	12 clys 1,044.00 cly	$12,528	
4. Manpower			
a. Supervision	1 person $75/hr 8 hrs/day 12 days/yr	$7,200	2-17
b. Operators	1 person $45/hr 8 hrs/day 52 days/yr	$18,720	2-17

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COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
5. Power/Energy			
a. Operating Equipment			
Well Pumps	0.22 kw		
Stripper Pump	0.70 kw		
Air Blower	4.10 kw		
Backwash Pump	0.90 kw		
Supernatant Pump	0.20 kw		
Reinjection Pumps	3.00 kw		
Miscellaneous	1.00 kw		
TOTAL	10.12 kw		
	10.12 kw 24 hrs/day 365 days/yr $0.100/kwhr	$8,865	2-17
b. Lighting	1 kw 24 hrs/day 365 days/yr $0.100/kwhr	$876	2-17
c. Building Heat	$200 month 8 months/year	$1,600	
		$11,341	
6. Sludge Disposal*	$0.25/gal 12 months/year	$3,650	2-17
7. Maintenance	6% of TCC	$32,500	2-17
8. Contingency	5% of O&M Costs	$ 4,800	2-17
TOTAL ANNUAL TREATMENT O&M COST		$100,900	2-17

*Sludge Generation based on 2.7 mg/l Fe influent, sludge @ 1% solids, sludge generation rate = 40 gal/d

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 3
TABLE B-4 (CDM)

ALTERNATIVE 4A1: GROUNDWATER PUMPING/AIR STRIPPING/ON-SITE DISCHARGE
CAPITAL COST ESTIMATES (1990 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
I. PUBLIC AWARENESS PROGRAM	1	Included in Installation		5,000.00	5,000.00	5,000.00
II. MONITORING WELLS						
a. Shallow	1	Included in Installation		3,500.00	3,500.00	3,500.00
b. Intermediate	5	Included in Installation		7,000.00	35,000.00	35,000.00
c. Deep	3	Included in Installation		7,500.00	22,500.00	22,500.00
						61,000.00
III. SITE PREPARATION						
1. Equipment Foundation	93 cy	Included in Installation		450.00	41,850.00	41,850.00
2. Equipment Storage Area	1	Included in Installation		8,000.00	8,000.00	8,000.00
						49,850.00
IV. PUMPING WELL AND COLLECTION SYSTEM						
1. Well (upper aquifer)	3 ea	Included in Installation		3,500.00	10,500.00	10,500.00
2. Well (lower aquifer)	3 ea	Included in Installation		9,200.00	27,600.00	27,600.00
3. Well Pump (upper aquifer)	3 ea	500.00	1,500.00	100.00	300.00	1,800.00
4. Well Pump (lower aquifer)	3 ea	600.00	1,800.00	100.00	300.00	2,100.00
5. Piping:						
a. 2 inch PVC	2,200 lf	Included in Installation		3.56	7,832.00	7,832.00
b. Trenching	2,200 lf	Included in Installation		1.40	3,080.00	3,080.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						53,912.00
V. EQUALIZATION & CHEMICAL FEED						
1. Equalization Tank	1	Included in Installation		4,000.00	4,000.00	4,000.00
2. Chemical Feed System:						
a. Chemicals	1 ea	Included in Installation		600.00	600.00	600.00
b. Chlorine	1 ea	Included in Installation		600.00	600.00	600.00
						5,200.00
VI. AIR STRIPPER	1	16,000.00	16,000.00	4,000.00	4,000.00	20,000.00

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
VII. LEACHING GALLERIES						
1. Leaching Pools	10	Included in Installation			15,000.00	15,000.00
2. Piping:						
a. 2 inch PVC	9,000 lf	Included in Installation		3.56	32,040.00	32,040.00
b. Trenching	4,500 lf	Included in Installation		1.40	6,300.00	6,300.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						54,340.00
VIII. TREATMENT SYSTEM PIPING & VALVES						
a. 2 inch PVC	200 lf	Included in Installation		3.56	712.00	712.00
b. Valves	30 ea	Included in Installation		65.00	1,950.00	1,950.00
						2,662.00
IX. INSTRUMENTATION AND CONTROLS	LS			10,000.00		10,000.00
X. ELECTRICAL	LS	Included in Installation		25,500.00		25,500.00

Total Direct Cost (TDC)	287,464
Contingency @20% of TDC	57,493
Engineering @20% of TDC	57,493
Legal and Administrative @5% of TDC	14,373
TOTAL CONSTRUCTION COST	416,800

Key

lf = linear feet
LS = lump sum
sy = square yard

Note: Alternative 4A-1: Pump and treat by air stripping, recharge by leaching galleries, no iron removal.

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 4
TABLE B-4 (CDM)

ALTERNATIVE 4A1: GROUNDWATER PUMPING/
AIR STRIPPING/ON-SITE DISCHARGE

ANNUAL OPERATION AND MAINTENANCE COST ESTIMATES (1990 DOLLARS)

COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
1. Site Monitoring (0-5 years) (See O&M for Alternative 1)		52,605	0-5
2. Site Monitoring (5-30 years) (See O&M for Alternative 1)		18,585	5-30
TREATMENT O&M COSTS			
3. Chemicals			
a. H2SO4	4,406 lbs 0.50/lb	$2,203	2-17
b. Chlorine	12 clys 1,044.00 cly	$12,528	2-17
4. Manpower			
a. Supervision	1 person $75/hr 8 hrs/day 12 days/yr	$7,200	2-17
b. Operators	1 person $45/hr 8 hrs/day 52 days/yr	$18,720	2-17

COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
5. Power/Energy			
a. Operating Equipment			
Well Pumps	0.22 kw		
Stripper Pump	0.70 kw		
Air Blower	4.10 kw		
Miscellaneous	1.00 kw		
TOTAL	6.02 kw		
	6.02 kw 24 hrs/day 365 days/yr $0.100/kwhr	$5,274	2-17
b. Lighting	1 kw 24 hrs/day 365 days/yr $0.100/kwhr	$876	2-17
c. Building Heat	$200 month 8 months/year	$1,600	
6. Maintenance	6% of TCC	$25,000	2-17
7. Contingency	5% of O&M Costs	$ 3,670	2-17
TOTAL ANNUAL TREATMENT O&M COST		$77,000	2-17

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 5
TABLE B-5 (CDM)

ALTERNATIVE 4B: GROUNDWATER PUMPING/CARBON ADSORPTION/ON-SITE DISCHARGE
CAPITAL COST ESTIMATES (1990 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
I. PUBLIC AWARENESS PROGRAM	1	Included in Installation		5,000.00	5,000.00	5,000.00
II. MONITORING WELLS						
a. Shallow	1	Included in Installation		3,500.00	3,500.00	3,500.00
b. Intermediate	5	Included in Installation		7,000.00	35,000.00	35,000.00
c. Deep	3	Included in Installation		7,500.00	22,500.00	22,500.00
						61,000.00
III. SITE PREPARATION						
1. Equipment Foundation	93 cy	Included in Installation		450.00	41,850.00	41,850.00
2. Equipment Storage Area	1	Included in Installation		8,000.00	8,000.00	8,000.00
						49,850.00
IV. PUMPING WELL AND COLLECTION SYSTEM						
1. Well (upper aquifer)	3 ea	Included in Installation		3,500.00	10,500.00	10,500.00
2. Well (lower aquifer)	3 ea	Included in Installation		9,200.00	27,600.00	27,600.00
3. Well Pump (upper aquifer)	3 ea	500.00	1,500.00	100.00	300.00	1,800.00
4. Well Pump (lower aquifer)	3 ea	600.00	1,800.00	100.00	300.00	2,100.00
5. Piping:						
a. 2 inch PVC	2,200 lf	Included in Installation		3.56	7,832.00	7,832.00
b. Trenching	2,200 lf	Included in Installation		1.40	3,080.00	3,080.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						53,912.00
V. EQUALIZATION & CHEMICAL FEED						
1. Equalization Tank	1	Included in Installation		4,000.00	4,000.00	4,000.00
2. Chemical Feed System:						
a. Polymer	1 ea	Included in Installation		1,600.00	1,600.00	1,600.00
b. Chemicals	2 ea	Included in Installation		600.00	1,200.00	1,200.00
c. Chlorine	1 ea	Included in Installation		600.00	600.00	600.00
						7,400.00
VI. CARBON ABSORPTION						
a. Carbon Units	2	Included in Installation		50,000.00	50,000.00	50,000.00
b. Building	1	Included in Installation		20,000.00	20,000.00	20,000.00
						70,000.00

eder associates consulting engineers, p.c.

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FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
VII. PRESSURE FILTER						
1. Static Mixer	1	Included in Installation		400.00	400.00	400.00
2. Multi Media Pressure Filter	1	Included in Installation		9,000.00	9,000.00	9,000.00
3. Backwash Waste Tank	1	Included in Installation		6,000.00	6,000.00	6,000.00
4. Supernatant Pump	1	400.00	400.00	100.00	100.00	500.00
5. Clearwell Tank	1	Included in Installation		6,000.00	6,000.00	6,000.00
						21,900.00
VIII. REINJECTION WELLS						
1. Well (upper aquifer)	6 ea	Included in Installation		3,500.00	21,000.00	21,000.00
2. Well (lower aquifer)	6 ea	Included in Installation		9,200.00	55,200.00	55,200.00
3. Well Discharge Pump	1 ea	450.00	450.00	100.00	100.00	550.00
4. Piping:						
a. 2 inch PVC	9,000 lf	Included in Installation		3.56	32,040.00	32,040.00
b. Trenching	4,500 lf	Included in Installation		1.40	6,300.00	6,300.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						116,090.00
IX. TREATMENT SYSTEM PIPING & VALVES						
a. 2 inch PVC	200 lf	Included in Installation		3.56	712.00	712.00
b. Valves	30 ea	Included in Installation		65.00	1,950.00	1,950.00
						2,662.00
X. INSTRUMENTATION AND CONTROLS	LS			10,000.00		10,000.00
XI. ELECTRICAL	LS	Included in Installation		25,500.00		25,500.00

Total Direct Cost (TDC)	423,314
Contingency @20% of TDC	84,663
Engineering @20% of TDC	84,663
Legal and Administrative @5% of TDC	21,666
TOTAL CONSTRUCTION COST	613,800

Key

lf = linear feet
LS = lump sum
sy = square yard

Note: Alternative 4B: CDM's Alternative - Pump and treat by GAC, recharge by injection wells - cost reflect revised iron sludge and spent carbon generation rates.

eder associates consulting engineers, p.c.

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 6
TABLE B-5 (CDM)

ALTERNATIVE 4B: GROUNDWATER PUMPING/
CARBON ADSORPTION/ON-SITE DISCHARGE

ANNUAL OPERATION AND MAINTENANCE COST ESTIMATES (1990 DOLLARS)

COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
1. Site Monitoring (0-5 years) (See O&M for Alternative 1)		52,605	0-5
2. Site Monitoring (5-30 years) (See O&M for Alternative 1)		18,585	5-30
TREATMENT O&M COSTS			
3. Chemicals			
a. Chlorine	12 clys 1,044.00 cly	$12,528	2-17
b. Carbon	4,000 lbs 1.15/lb	$ 4,600	2-17
4. Manpower			
a. Supervision	1 person $75/hr 8 hrs/day 12 days/yr	$7,200	2-17
b. Operators	1 person $45/hr 8 hrs/day 52 days/yr	$18,720	2-17

COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
5. Power/Energy			
a. Operating Equipment			
Well Pumps	0.22 kw		
GAC Pump	0.70 kw		
Miscellaneous	1.00 kw		
TOTAL	1.92 kw		
	1.92 kw 24 hrs/day 365 days/yr $0.100/kwhr	$1,682	2-17
b. Lighting	1 kw 24 hrs/day 365 days/yr $0.100/kwhr	$876	2-17
c. Building Heat	$200 month 8 months/year	$1,600	2-17
6. Sludge Disposal*	$0.25/gal 12 months/year	$3,650	2-17
7. Maintenance	6% of TCC	$36,800	2-17
8. Contingency	5% of O&M Costs	$ 4,383	2-17
TOTAL ANNUAL TREATMENT O&M COST		$92,000	2-17

*Sludge Generation based on 2.7 mg/l Fe influent, sludge @ 1% solids, sludge generation rate = 40 gal/d

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MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 7
TABLE B 5 (CDM)

ALTERNATIVE 4B-1: GROUNDWATER PUMPING/CARBON ADSORPTION/ON-SITE DISCHARGE
CAPITAL COST ESTIMATES (1990 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
I. PUBLIC AWARENESS PROGRAM	1	Included in Installation		5,000.00	5,000.00	5,000.00
II. MONITORING WELLS						
a. Shallow	1	Included in Installation		3,500.00	3,500.00	3,500.00
b. Intermediate	5	Included in Installation		7,000.00	35,000.00	35,000.00
c. Deep	3	Included in Installation		7,500.00	22,500.00	22,500.00
						61,000.00
III. SITE PREPARATION						
1. Equipment Foundation	93 cy	Included in Installation		450.00	41,850.00	41,850.00
2. Equipment Storage Area	1	Included in Installation		8,000.00	8,000.00	8,000.00
						49,850.00
IV. PUMPING WELL AND COLLECTION SYSTEM						
1. Well (upper aquifer)	3 ea	Included in Installation		3,500.00	10,500.00	10,500.00
2. Well (lower aquifer)	3 ea	Included in Installation		9,200.00	27,600.00	27,600.00
3. Well Pump (upper aquifer)	3 ea	500.00	1,500.00	100.00	300.00	1,800.00
4. Well Pump (lower aquifer)	3 ea	600.00	1,800.00	100.00	300.00	2,100.00
5. Piping:						
a. 2 inch PVC	2,200 lf	Included in Installation		3.56	7,832.00	7,832.00
b. Trenching	2,200 lf	Included in Installation		1.40	3,080.00	3,080.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						53,912.00
V. EQUALIZATION & CHEMICAL FEED						
1. Equalization Tank	1	Included in Installation		4,000.00	4,000.00	4,000.00
2. Chemical Feed System:						
a. Chlorine	1 ea	Included in Installation		600.00	600.00	600.00
						4,600.00
VI. CARBON ABSORPTION						
a. Carbon Units	2	Included in Installation		25,000.00	50,000.00	50,000.00
b. Building	1	Included in Installation		20,000.00	20,000.00	20,000.00
						70,000.00

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, $ UNIT PRICE	MATERIAL, $ COST	INSTALLATION, $ UNIT PRICE	INSTALLATION, $ COST	DIRECT COST, $
VII. LEACHING GALLERIES						
1. Leaching Pools	10	Included in Installation			15,000.00	15,000.00
2. Piping:						
a. 2 inch PVC	9,000 lf	Included in Installation		3.56	32,040.00	32,040.00
b. Trenching	4,500 lf	Included in Installation		1.40	6,300.00	6,300.00
c. Road crossing	40 lf	Included in Installation		25.00	1,000.00	1,000.00
						54,340.00
VIII. TREATMENT SYSTEM PIPING & VALVES						
a. 2 inch PVC	200 lf	Included in Installation		3.56	712.00	712.00
b. Valves	30 ea	Included in Installation		65.00	1,950.00	1,950.00
						2,662.00
IX. INSTRUMENTATION AND CONTROLS	LS			10,000.00		10,000.00
X. ELECTRICAL	LS	Included in Installation		25,500.00		25,500.00

Total Direct Cost (TDC)	336,864
Contingency @20% of TDC	67,373
Engineering @20% of TDC	67,373
Legal and Administrative @5% of TDC	23,581
TOTAL CONSTRUCTION COST	495,200

Key

lf = linear feet
LS = lump sum
sy = square yard

Note: Alternative 4B-1: Pump and treat by GAC, recharge by leaching galleries, no iron removal - costs reflect revised spent carbon generation rate.

MANNHEIM AVENUE SITE
GALLOWAY TOWNSHIP, NEW JERSEY

TABLE 8
TABLE B-5 (CDM)

ALTERNATIVE 4B1: GROUNDWATER PUMPING/
CARBON ADSORPTION/ON-SITE DISCHARGE

ANNUAL OPERATION AND MAINTENANCE COST ESTIMATES (1990 DOLLARS)

COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
1. Site Monitoring (0-5 years) (See O&M for Alternative 1)		52,605	0-5
2. Site Monitoring (5-30 years) (See O&M for Alternative 1)		18,585	5-30
TREATMENT O&M COSTS			
3. Chemicals			
a. Chlorine	12 clys 1,044.00 cly	$12,528	2-17
b. Carbon	4,000 lbs 1.15/lb	$ 4,600	2-17
4. Manpower			
a. Supervision	1 person $75/hr 8 hrs/day 12 days/yr	$7,200	2-17
b. Operators	1 person $45/hr 8 hrs/day 52 days/yr	$18,720	2-17

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COST COMPONENT	BASIS OF ESTIMATE	O&M COST ESTIMATE	YEAR
5. Power/Energy			
a. Operating Equipment			
Well Pumps	0.22 kw		
GAC Pump	0.70 kw		
Miscellaneous	1.00 kw		
TOTAL	1.92 kw		
	1.92 kw 24 hrs/day 365 days/yr $0.100/kwhr	$1,682	2-17
b. Lighting	1 kw 24 hrs/day 365 days/yr $0.100/kwhr	$876	2-17
c. Building Heat	$200 month 8 months/year	$1,600	2-17
6. Maintenance	6% of TCC	$29,711	2-17
8. Contingency	5% of O&M Costs	$ 3,846	2-17
TOTAL ANNUAL TREATMENT O&M COST		$80,800	2-17

and the cost and possibility of obtaining land through right or outright purchase. Given the modeling results, it may be necessary to have this system in place and operational within three years.

Cost - The estimated capital costs for this alternative is $387,000 for the existing residential wells and $427,000 for the existing and potential future residential wells. This cost does not include land acquisitions. The estimated annual operation and maintenance cost is $55,000 for the existing residential wells and $64,000 for the existing and potential future residential wells. The present worth amount of the O&M is $571,000 for the existing residential wells and $664,000 for the existing and potential future residential wells if the restoration time is 15 years; and $846,000 for the existing residential wells and $984,000 for the existing and potential future residential wells if the restoration time is assumed to be 30 years. The total cost is $959,000 for the existing residential wells and $1,100,000 for the existing and potential future residential wells for 15 year restoration timeframe; and $1,200,000 for the existing residential wells and $1,400,000 for the existing and potential future residential wells for a 30 year restoration timeframe.

3.3.4. Alternative 4: Groundwater Pumping to Restore the Aquifer/Air Stripping/Groundwater Monitoring/ Institutional Controls and Point of Use Controls

Description

The objective of this alternative is to restore the aquifer by pumping groundwater from the shallow and deep plumes. Groundwater would be pumped from extraction wells and treated on-site using air stripping. The treated water would be recharged to the shallow aquifer via leaching pools.

The effectiveness of the pumping system is dependent on the placement of the extraction wells. Extraction wells cannot be installed at the downgradient edge of the plume because the 1 ppb edge of the plume is poorly defined, diffuse in nature, and virtually impossible to monitor. Installing an extraction system at the inferred 1 ppb leading edge of the plume would not be technically feasible for the following reasons:

- The monitoring problem would make it extremely difficult to locate the pumping system at the leading edge of the plume and it would be necessary to install a large and redundant number of wells, most of which would only yield clean water.

- The low concentration of TCE would mean that pumpage would be very dilute and the system would effectively pump clean water. If the TCE concentrations in the pumpage are diluted to below detectable limits, it would not be possible to determine that the plume is intercepted. Moreover, due to the low TCE concentration at the edge of the plume, monitoring wells could not be located downgradient of the recovery system to determine if any TCE breakthrough is occurring.

Given these conditions, it is not feasible to recover the shallow or deep plumes at the 1.0 ppb TCE level, therefore, this alternative would implement groundwater extraction within the plumes. Groundwater extraction within the plumes would allow the remaining uncontained portion of the shallow and deep plumes to dissipate naturally.

This alternative would implement a long-term groundwater monitoring program as discussed in Alternative 1. In-home GAC units would be installed if MCLs are exceeded at the residential wells as described in Alternative 2. Additional monitoring wells may be installed to track the plume. The number of wells and the sampling and analysis protocols would be established during the remedial design phase.

This alternative presents two implementation options:

1. Install the pump and treat system under current conditions, or

The Pinelands Commission

P.O. Box 7, New Lisbon, N. J. 08064 (609) 894-9342

August 15, 1990

Ms. Laura Lombardo
Site Compliance Branch
USEPA - REGION II
26 Federal Plaza
Room 747
New York, NY 10278

Re: App. No. 89-1280.01
Block 504, Lots 2, 3
Galloway Township
Mannheim Ave. Dump Site

Dear Ms. Lombardo:

Thank you for providing the Pinelands Commission with a copy of the Proposed Remedial Action Plan (PRAP) for the Mannheim Avenue Superfund Site.

The preferred alternative, groundwater pumping/air stripping/reinjection is generally acceptable to the Commission. However, the proposal to treat contaminated groundwater to meet drinking water standards (1ppb for TCE) is not acceptable.

As stated within our comments of March 26, 1990 (enclosed) the water quality standards of the Pinelands Comprehensive Management Plan (CMP) prohibits development which would degrade surface and ground water resources of the Pinelands.

The proposal to pump, treat and reinject to meet drinking water standards would not comply with the non-degradation standard of the CMP which along with the Pinelands Protection Act of 1979 and the National Parks and Recreation Act of 1978 quality as "Applicable or Relevant and Appropriate Requirements."

Therefore, the proposed remedial action plan should be amended to set a treatment level of non-detect for the contaminant of concern.

Further, the Commission has received a copy of the comments prepared by the N.J.D.E.P., Division of Hazardous Waste Management for the Remedial Investigation Report, the Feasibility Study and the Proposed Remedial Action Plan. It appears that several of the comments raise substantive and procedural issues with regard to the investigation and proposed remediation. The Commission relies on the Division for expertise regarding the technical aspects of Superfund Investigations. Therefore, the Commission requests your agency to address all the issues raised within their comments.

The Pinelands Commission will object to any Record of Decision which does not address the concerns raised herein.

If you have any questions regarding this matter, please contact Robert Howell of our staff.

Sincerely,

William Harrison

William Harrison, Esquire
Assistant Director

WH/mw/E3

cc: Haiyesh Shah, Case Manager, N.J.D.E.P.

Enclosure

The Pinelands Commission
P.O. Box 7, New Lisbon, N.J. 08064 (609) 894-9342

MEMORANDUM

TO: Laura Lombardo, USEPA

FROM: Robert G. Howell RGH
THROUGH: William F. Harrison

SUBJECT: MANNHEIM AVE. SITE

DATE: MARCH 26, 1990

The Pinelands Commission staff has reviewed the draft feasibility report for the Mannheim Ave. Site.

The Pinelands Commission has been charged with administering and enforcing the standards of the New Jersey Pinelands Comprehensive Management Plan (N.J.A.C.7:50-1.1 et seq). The Pinelands Comprehensive Management Plan (CMP) was adopted by the Pinelands Commission on January 14,1981, pursuant to the National Parks and Recreation Act of 1978 (Public Law 95-625, Section 502) and the The Pinelands Protection Act of 1979 (N.J.S.A. 18A-1 et seq). The Acts acknowledge the Pinelands Area as a unique and significant national resource. One of the stated objectives of the Federal and State Acts calls for the preservation and enhancement of the extensive surface and ground water resources of high quality through the development and implementation of a regional management plan. The CMP was designed to achieve the objectives of the Acts.

Therefore, the Acts and the Comprehensive Management Plan should be included as "Applicable or Relevant and Appropriate Requirements" (ARAR's). Specifically the Acts and adopted regulations should be listed as Relevant and Appropriate Requirements for which the alternative remediation proposal must achieve compliance.

The Mannheim Ave. Site is located in a Rural Development Management Area which generally permits development of densities not to exceed one dwelling unit for every 3.2 acres along with other uses which are compatible with the essential character of the Pinelands Environment. Just north of the site (down gradient, approx. .5 miles) is a Forest Management Area and the Preservation Area. The Forest Management Area provides a buffer or transition to the Preservation Area which is the core of the Pinelands Environment and represents the most critical ecological region in the Pinelands. These two Management Areas contain high quality water resources and wetlands. The overall type and level of development permitted within the Forest Areas and particularly within the Preservation District are strictly limited to protect and preserve their significant natural resources. The water quality standards of the Plan (promulgated as N.J.A.C. 7:50-6.8) require that no development be permitted which degrades surface of ground water quality. While the water quality standards of the CMP do not identify specific limits for the contaminant (trichloroethene, TCE) detected in the ground water at the site, the non-degradation standard should be applied to any proposed remediation. Proposed clean-up goals should be set to achieve the greatest percent removal of this substance.

Therefore, the recommendation to implement Alternative 2: Groundwater Monitoring/Institutional Controls is found to be unacceptable to the Pinelands Commission The Commission recommends that the remedial technology of ground water pumping be further evaluated . This should include the performance of limited pumping and sampling of the existing monitoring wells to confirm the described streaky and low concentration nature of the plume making this option not technically feasible.

At this time Alternative 2 cannot be considered to be consistent with the standards of the CMP.

The Pinelands Commission will object to any Record of Decision which does not address the standards of the Pinelands Comprehensive Management Plan and the concerns raised herein.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

SEP 20 1990

William Harrison, Esq.
Assistant Director
The Pinelands Commission
P.O. Box 7
New Lisbon, New Jersey 08064

Dear Mr. Harrison:

This letter is in response to your letter dated August 15, 1990 to Ms. Laura Lombardo of my staff, regarding the Proposed Plan for the Mannheim Avenue Dump Superfund Site in Galloway Township, New Jersey.

As part of the Feasibility Study prepared by the U.S. Environmental Protection Agency's (EPA's) contractor, four alternatives were evaluated to identify a permanent remedy to address the contaminated groundwater at the site. These alternatives will be discussed in detail in the Record of Decision for the site. The proposed remedial action includes groundwater collection with on-site treatment via air stripping and discharge into the aquifer system either via reinjection wells or infiltration basins.

In your August 15th letter, you suggested that the proposed cleanup goal for the contaminant of concern, trichloroethylene (TCE), in the aquifer be set at a nondetectable level based on the nondegradation objective of the Pinelands Comprehensive Management Plan (CMP). You also stated that the Pinelands CMP prohibits development which would degrade surface and groundwater resources of the Pinelands.

EPA's proposed cleanup action should not be considered new development which may degrade water quality in the Pinelands. Rather, the groundwater in the aquifer underlying the site is contaminated as a result of improper hazardous waste disposal. By extracting and treating this groundwater, the water quality will be significantly improved. For this reason, EPA does not believe that the nondegradation objective is an applicable requirement.

In addition, the groundwater underlying the site has been classified by the New Jersey Department of Environmental Protection (NJDEP) as Class GW II. Accordingly, drinking water standards, or Maximum Contaminant Levels (MCLs) established under the New Jersey Safe Drinking Water Act, N.J.A.C. 7:10-16.7, are the applicable cleanup standards for the Site. The MCL established for TCE is 1 part per billion (ppb).

The remediation planned by EPA may not reduce contaminant concentrations in the groundwater to background, or nondetectable levels. The treatment system will be designed to treat the extracted TCE-contaminated groundwater to the MCL of 1 ppb, in attempts to remediate the TCE contamination in the shallow and deep zones of the aquifer system to 1 ppb, as well.

In addition, with regard to your concern with the comments made by the NJDEP on the Feasibility Study and Proposed Plan, please be advised that EPA is in the process of resolving these matters with the Department.

EPA established a public comment period on the Proposed Plan and the Remedial Investigation and Feasibility Study reports for the Site, which extended from July 17 to August 15, 1990. On August 7, 1990, EPA held a public meeting to present EPA's proposed remedial action to the community and other interested parties, and to respond to oral questions and comments. After review of all comments, which the Agency receives concerning the proposed remedial action, EPA intends to proceed with a final remedial solution for the site that is protective of human health and the environment, cost-effective, and attains federal and state requirements that are applicable or relevant and appropriate.

Your cooperation in providing comments on the proposed remedial action is appreciated. I hope that the concerns raised by the Pinelands Commission have been fully addressed. Should you have any further questions in this matter, do not hesitate to contact me at (212) 264-8673, or have your staff contact Laura Lombardo, the project manager for the Mannheim Avenue Dump Site, at (212) 264-6787.

Sincerely yours,

Richard L. Caspe, P.E.
Director
Emergency and Remedial Response Division

cc: H. Shah, NJDEP-BFCM

APPENDIX B

Mannheim Avenue Superfund Site

Galloway Township, New Jersey

EPA

Region 2 — July 1990

ANNOUNCEMENT OF PROPOSED PLAN

This Proposed Plan describes the preferred alternative for addressing groundwater contamination at the Mannheim Avenue Site (Site) in Galloway Township, Atlantic County, New Jersey. This document is issued by the United States Environmental Protection Agency (EPA), the lead agency for site activities, and the New Jersey Department of Environmental Protection (NJDEP), the support agency for this response action. Only after the public comment period has ended and the information submitted during this time has been reviewed and considered will EPA, in consultation with NJDEP, make a decision as to what action(s) to take at this Site.

EPA is issuing this Proposed Plan as part of our public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation and Feasibility Study (RI/FS) Reports and other documents contained in the administrative record file for this Site. EPA and NJDEP encourage the public to review these and other documents in the administrative record in order to gain a more comprehensive understanding of the Site and the related Superfund activities conducted to date. The administrative record file contains the information upon which the selectionof the response action will be based. The file is available at the following locations:

Atlantic County Library
Galloway Township Branch
30 W. Jimmie Leeds Road
Pomona, NJ 08240
(609) 652-2352

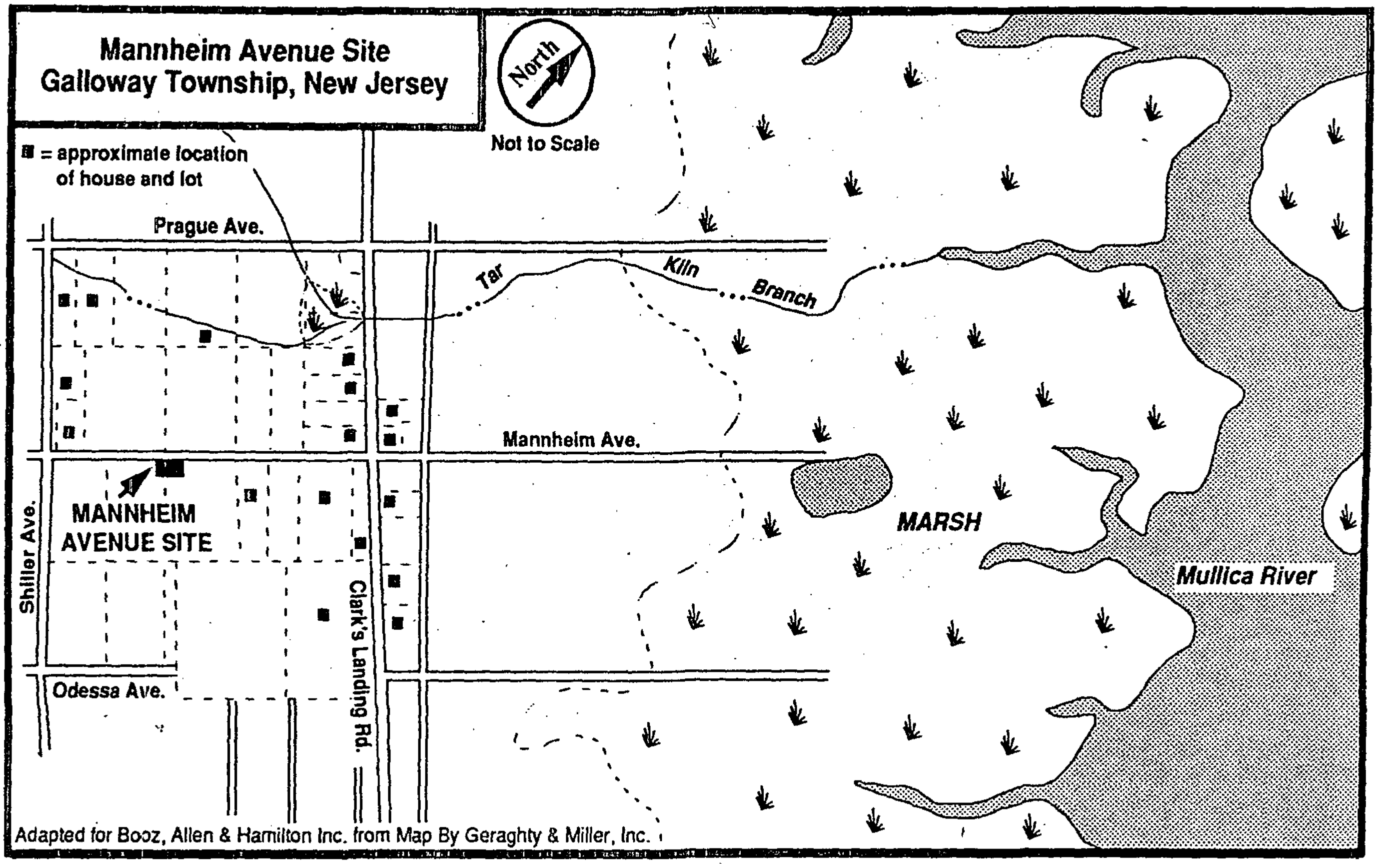
and

U.S. EPA Region II
Emergency & Remedial Response
Division File Room
26 Federal Plaza, 29th Floor
New York, New York 10278

EPA, in consultation with NJDEP, may modify the preferred alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified herein.

THE COMMUNITY'S ROLE IN THE SELECTION PROCESS

EPA solicits input from the community on the cleanup methods proposed for each Superfund response action. **EPA has set a public comment period from July 17 through August 15, 1990 to encourage public participation in the selection of a remedy for the Site.** The comment period includes a public meeting at which EPA will discuss the RI/FS reports and Proposed Plan, answer questions, and accept both oral and written comments.



<u>**The public meeting for the Site is scheduled for August 7, 1990 from 7 pm until 9 pm, and will be held at the Atlantic County Library/Mays Landing, 2 South Farragut Avenue, Mays Landing, New Jersey 08330.**</u>

Comments will be summarized and responses provided in the Responsiveness Summary section of the Record of Decision (ROD). The ROD is the document that presents EPA's final selection for response action. <u>**Written comments on this Proposed Plan should be sent by close of business August 15, 1990 to:**</u>

Laura Lombardo
Project Manager
U.S. Environmental Protection Agency
Emergency and Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278

SITE BACKGROUND

The Mannheim Avenue Site is located in a two-acre sand and gravel clearing on Mannheim Avenue between Shiller Road and Clarks Landing Road in Galloway Township, Atlantic County, New Jersey. The Site is owned by the Township of Galloway and lies within the New Jersey Pinelands Protection Area. At least 82 residents live within a one-mile radius of the Site. The Bethel Christian Day School is located within 5000 feet south of the Site. Historically, the Site was mined for sand and gravel for the construction of township roads. Upon completion of the mining operations, the excavated portion of the cleared area was used for waste disposal. At some point after the onset of disposal activities, wastes on the floor of the pit were compacted into mounds by the township operators and covered with soil.

The Township of Galloway and Lenox China are the only known sources of the wastes deposited at the Site. During the years 1964 to 1967, Lenox China, with the approval of the township, sent waste produced at their manufacturing plant in Pomona, New Jersey, to the Site for disposal. This waste was in the form of a solid asphaltic degreas-

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ing sludge, with trichloroethylene (TCE) as its primary constituent. This waste material also contained smaller amounts of other volatile organic compounds (VOCs) and heavy metals (lead and cadmium). Lenox also disposed of leaded glaze waste, plaster molds, broken chinaware, clay forms, and general trash at the Site, which were mixed in with other debris in the mounded soil. The township also disposed of general trash waste at the Site.

The Site was placed on the National Priorities List in 1983. In December 1984, EPA issued an Administrative Order to Lenox and the Township of Galloway to remove the waste material buried in the soil mounds at the Site, conduct soil and groundwater sampling, and excavate and remove contaminated soil from the Site. By August 1985, Lenox had completed the excavation of the waste material from the soil mounds. Approximately 25,000 pounds of wastes were removed from the Site and incinerated off site. Thirty-five mounds of soil remained, many with residual contamination.

In 1985 and 1986, Lenox sampled the asphaltic sludge material as well as the soil on site, the groundwater on site and within a half mile radius from the Site, and a nearby stream. This sampling showed that the principal contaminants associated with the waste at the Site were lead and TCE. Soil sampling revealed that lead was the predominant contaminant remaining within the soil mounds (at levels up to 48,000 parts per million (ppm)). Several of the mounds also contained small fragments of the asphaltic sludge waste which could not be separated from the soil during the initial excavation. These mounds were assumed to contain TCE as well as lead contaminants. Groundwater sampling on site revealed the presence of TCE (at levels up to 140 parts per billion (ppb)). Groundwater sampling from residential and school wells, and from the nearby stream did not reveal the presence of any site-related contaminants.

In July 1988 and March 1989, EPA sampled the drinking water from 25 local residential wells surrounding the Site and one well from the Bethel Christian School for VOCs and metals. No VOCs or metals were detected above EPA's drinking water standards.

In May 1988, EPA entered into an Administrative Order on Consent with Lenox, Inc. and the Township of Galloway, in which Lenox agreed to conduct a Remedial Investigation (RI) and Feasibility Study (FS) at the Site.

In June 1989, the 35 mounds of soil containing residual lead and TCE contamination were excavated and disposed off site by Lenox.

REMEDIAL INVESTIGATION SUMMARY

The objectives of the RI were to characterize the nature and extent of any contamination associated with the Site, to identify migration of contamination and its impact on public health and the environment, and to determine whether there is a need for remedial measures to protect human health and the environment. The investigations evaluated soil, groundwater, air, and surface water/sediment quality.

The detailed results of the RI can be found in the Remedial Investigation Report, contained in the administrative record file noted on page 1. The results of the investigation can be summarized as follows:

- The geology of the Site is comprised of the following units of the Cohansey Sand and Kirkwood Formation, in descending order: a shallow aquifer (which occurs approximately 35 feet below the ground surface), a semi-permeable clay unit (approximately three to five feet thick which occurs approximately 50 feet below the ground surface), and a deep aquifer.

- In the shallow aquifer, groundwater flows towards the northwest. In the deep aquifer, groundwater flows towards the northeast.

- Shallow and deep groundwater quality has been adversely impacted at the Site by TCE. The shallow aquifer contains TCE up to a concentration level of 29 ppb. It is roughly estimated that the entire length of the shallow TCE plume, including the 400-foot diameter of the Site itself, is assumed to be 1000 feet, with a width of 400 feet and thickness of 15 feet. The deeper aquifers contains TCE up to a concentration level of 47 ppb. It is roughly estimated that the deeper TCE plume length, including the Site, is greater than 1000 feet, and that it is 1000 feet wide and 55 feet thick.

- It is believed that the clay unit separating the shallow and deep aquifer may contain some TCE residues within the area that underlies the shallow contaminant plume.

- Other VOCs, as well as lead and chromium, were sporadically detected in the shallow and deep aquifers, in some instances at levels exceeding NJDEP drinking water standards. Although these compounds were sporadically detected, EPA will require monitoring of these compounds in the future.

- Surficial soil sampling performed after the soil mounds were removed from the Site in June 1989, indicates that soil quality at the Site is not adversely impacted. It is possible that the soil zone lying above the shallow aquifer (unsaturated zone) may contain small amounts of TCE residues.

- Surface water and sediment sampling of the Tar Kiln Branch indicate that the Site is not presently impacting this area.

SCOPE AND ROLE OF RESPONSE ACTION

The principal threat posed by the Site is groundwater contaminated with TCE exceeding the State drinking water standard of 1 ppb (the maximum contaminant level (MCL)), which has migrated off of the property boundary and may adversely impact residential drinking water wells.

SUMMARY OF SITE RISKS

An analysis was conducted by EPA through its contractor to estimate the health and environmental impacts that could potentially result from the Site. This analysis is commonly referred to as a baseline risk assessment. Findings from this assessment include the following:

- The contaminated medium of concern is the groundwater (both shallow and deep aquifers).

- The primary contaminant of concern is TCE, a suspected human carcinogen.

- The principal routes of potential exposure to TCE are through residential uses of groundwater including ingestion of well water, dermal exposure to well water while bathing, and inhalation of volatile TCE from well water.

- The current potentially exposed population includes fourteen houses with drinking water wells which are situated downgradient of the shallow and deep TCE plumes. Based on current zoning, an additional six houses could be built in the future, in areas downgradient of the Site.

- As evidenced by the data collected to date, site-related contaminants have not migrated to residential wells. There is no current exposure to TCE-contaminated groundwater; therefore, there is no current health risk to residents at the Site. However, the potential exists for future contact with TCE-contaminated groundwater by current or future residents downgradient of the Site.

- Aside from the TCE contaminants in the groundwater, the Site poses minimal impact to natural resources and the environment adjacent to the Site.

- Implementation of the Preferred Alternative will reduce TCE concentration levels to meet drinking water standards.

SUMMARY OF ALTERNATIVES

A feasibility study (FS) was conducted by Eder Associates for Lenox to develop and evaluate potential remedial alternatives to address the TCE-contaminated groundwater at the Site. This FS report did not provide a complete analysis of each remedial alternative. Consequently, EPA tasked its contractor, CDM Federal Programs Corporation (CDM-FPC), to prepare a FS report to develop and evaluate remedial alternatives more thoroughly. The alternatives evaluated in the detailed analysis of the CDM-FPC FS report are discussed below.

Alternative 1: No Action with Groundwater Monitoring

Capital Cost: $89,100
Annual Operation and Maintenance
(O&M) Costs: $52,600 (years 1 to 5)
$18,600 (years 5 to 30)
Present Worth (PW): $ 550,100
Months to Implement: 3 months

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The No Action alternative is evaluated at every site to establish a baseline for comparison. Under this alternative, no active action would be taken at the Site to prevent or reduce migration of, or reduce concentration levels of, TCE in the groundwater. This alternative relies on natural attenuation of contaminants in the groundwater to reduce TCE concentration levels to the MCL of 1 ppb. This alternative includes a long-term monitoring program to assess the migration of contamination in the shallow and deep aquifers. This program would use existing monitoring wells, newly installed monitoring wells, and residential wells in the vicinity of the Site. Selected wells would be sampled on a quarterly basis for the first five years, and then biannually. This alternative also includes an educational program to inform the public about potential hazards at the Site. The amount of time required for natural attenuation to reduce contaminant levels to drinking water standards is not known at this time because of the uncertainties relating to the presence and degree of residual contamination in the unsaturated zone and in the clay layer separating the shallow aquifer from the deep aquifer. The potential exists for this residual contamination to continue to release slowly into the groundwater at an unknown rate and over an unknown period of time.

Alternative 2: Point-of-Use Carbon Adsorption Treatment/Water-Use Restrictions

Capital Cost: $ 147,150
Annual O&M Cost: $52,600 (years 1 to 5)
$50,900 (year 6)
$32,000 (years 7 to 21)
$18,600 (years 22 to 30)
Present Worth: $ 739,400
Months to Implement: 1 month to install point-of-use control; 12 months for water use restrictions

This alternative includes all of the components of Alternative 1, with the addition of provisions to install and maintain individual carbon adsorption treatment systems at residential wells, if groundwater monitoring (performed on a quarterly basis for the first five years) indicates that the groundwater contamination is migrating and threatening the residential wells. The carbon adsorption system would remove organic and, to some degree, inorganic contaminants. The treated water would then be used as needed by residents. In addition, this alternative would place legal restrictions on the installation of any new wells in the vicinity of the contamination. Any new or existing downgradient wells in the future would require the installation of a treatment system, if it was determined that water quality was threatened by site contamination. The individual treatment systems and the water-use restrictions would be temporary and would be in place until groundwater quality has been restored.

Alternative 3: Alternate Water Supply/Water-Use Restrictions

Capital Cost: $492,100
Annual O&M Cost: $52,600 (years 1 to 5)
$94,300 (years 6 to 30)
Present Worth: $1,749,200
Months to Implement: 18 months

This alternative includes all of the components of Alternative 1, with the addition of the development of water supply well(s) and a distribution system to provide potentially affected residences with a continuous source of clean water, if groundwater monitoring (performed on a quarterly basis for the first five years) indicates that the groundwater contamination is migrating and threatening the residential wells. The water supply well(s) would be installed near the Site in an area outside the TCE contamination. Groundwater use-restrictions would require that all existing and future households be connected to this supply and that residential wells be taken out of service.

Alternative 4: Groundwater Pumping/Air Stripping/Reinjection

Capital Cost: $ 541,000
Annual O&M Cost: $52,600 (year 1)
$394,100 (years 2 to 5)
$360,100 (years 6 to 17)
$18,600 (years 18 to 30)
Present Worth: $4,217,100
Months to Implement: 24 months

This alternative includes the installation of groundwater extraction wells to withdraw the contaminated water for on-site treatment with discharge through reinjection into the shallow and deep aquifers. Three extraction wells would be installed in each aquifer. Two wells in each aquifer would be operated continuously and the third would serve as a backup well during periods of well maintenance. Six reinjection wells would be installed in each aquifer. Three wells in each aquifer would be operated continuously and the additional three wells would serve as backups to be used during maintenance periods. Contaminated water would be pumped from the shallow aquifer wells and deep aquifer wells at total rates of 10 gallons per minute (gpm) and 40 gpm, respectively. Contaminants in the extracted groundwater would be pre-treated to remove iron and then air stripped to reduce the level of VOCs to meet drinking water standards. This alternative also includes short-term sampling of downgradient groundwater monitoring wells and residential wells, during the design period, to monitor the potential migration of contaminants towards residential wells until the treatment system is operational. In addition, this alternative includes long-term sampling of downgradient monitoring wells and residential wells, once the system is operational, to monitor the effectiveness of the treatment system in removing contaminants and preventing migration. The length of time required for this alternative to reduce contaminant levels to drinking water standards is approximately six to sixteen years. This time period takes into consideration the influence of the potential residual contamination in the unsaturated zone and in the clay layer. Additional testing will be required to evaluate the schedule for aquifer restoration further. Furthermore, during the design period, EPA may assess the feasibility and practicality of using infiltration basins as an alternate means of discharging treated groundwater to the underlying aquifer.

EVALUATION OF ALTERNATIVES AND PREFERRED ALTERNATIVE

The preferred alternative is Alternative 4. This alternative provides the best balance of trade-offs among the alternatives with respect to the criteria that EPA uses to evaluate alternatives. This section profiles the performance of the preferred alternative against the criteria which apply to this action, while noting how it compares to the other options under consideration.

Overall Protection of Human Health and the Environment: This criterion addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls or institutional controls. Alternative 1 is not protective of human health and the environment because, along with Alternatives 2 and 3, it would not remove contaminants from the groundwater in the shallow and deep aquifers, and thereby allows the migration of contaminants into clean portions of the aquifers. Also, Alternative 1 would not prevent the potential contamination of residential wells from migration of contaminants. Alternatives 2 and 3, while not protective of the environment, protect human health because they include treatment at the well-head and an alternate water supply, respectively, if monitoring indicates contamination of residential wells. Alternative 4 protects public health and the environment because it provides for the removal of contaminants from the groundwater in the aquifers to meet drinking water standards, and prevents migration of contaminants towards residential wells.

Compliance with ARARs: This criterion addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental statutes (other than CERCLA) and/or provide grounds for invoking a waiver. Alternatives 1, 2 and 3 rely on natural attenuation of the contaminants in the groundwater to eventually meet the MCL of 1 ppb in the aquifers through dilution of the volume of contaminants. Alternatives 2 and 3 meet the ARAR associated with providing safe drinking water to community residents by removing the VOCs from the water through well-head treatment, and providing an alternate drinking water supply, respectively. Alternative 4, in actively removing contaminants from the groundwater and preventing contaminant migration towards residential wells, meets ARARs in the aquifers and at the residential wells.

Long-term Effectiveness: This criterion refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. Alternative 1 does not provide for long-term protection of human health and the environment over time. This alternative does not actively contribute to restoration of the groundwater. Uncontaminated groundwater currently used for drinking water may be jeopardized in the future by the spread of contamination. Alternatives 2 and 3 would permanently protect individual residents from drinking contaminated groundwater. However, these alternatives would not prevent contaminants from adversely affecting clean portions of the groundwater. Alternative 4 provides for permanent long-term effectiveness in the protection of human health and the environment over time.

Reduction of Toxicity, Mobility or Volume: This criterion addresses the degree to which a remedy utilizes treatment to reduce the toxicity, mobility or volume of contaminants at the Site. Alternatives 1, 2 and 3 do not utilize treatment to reduce the toxicity, mobility or volume of contaminants in the shallow and deep aquifers. These alternatives would not reduce the mobility of the contaminants in the aquifers, and would rely on natural attenuation, through dilution over time, to reduce the

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toxicity and volume of contaminants. Alternatives 2 and 3 use treatment via individual carbon adsorption units and an alternative water supply, respectively, to reduce the toxicity and volume of contaminants in the groundwater prior to use by residents. Alternative 4 would reduce the toxicity, mobility and volume of contaminants in the aquifer by extracting contaminated groundwater and treating it to meet drinking water standards.

Short-term Effectiveness: This criterion refers to the time in which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period. Implementation of Alternatives 1, 2, 3 and 4 would not create any adverse short-term impacts on human health and the environment. The time to achieve protection from contaminants in the groundwater is longer for Alternatives 1, 2 and 3 than for Alternative 4. Alternatives 1, 2 and 3 rely on natural attenuation over time to reduce contaminant concentration levels in the groundwater to drinking water standards. The amount of time required for natural attenuation would be influenced by the potential for residual contaminants in the unsaturated zone and in the clay layer to continue to release slowly into the aquifers. Alternative 4, while incapable of quickening the release of residual contamination potentially in the clay layer, provides for active removal of the contaminants which already exist in the aquifers, as well as active removal of the contaminants as they enter the aquifers after being released from the unsaturated zone and clay layer. Therefore, Alternative 4 achieves protection in a lesser time frame than Alternatives 1, 2 and 3.

Implementability: Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the selected alternative. All alternatives are implementable. Alternatives 1, 2 and 3 involve considerable long-term institutional management. Alternatives 2 and 3 require the cooperation of local residents, administrative management to operate and maintain the point-of-use treatment systems, and the supply and distribution system, respectively, as well as the enforcement of water-use restrictions. The implementation and enforcement of these restrictions may be difficult. The groundwater monitoring program included as part of each alternative may require some administrative management and cooperation of local residents.

Cost: Cost includes capital and operation and maintenance (O&M) costs. The present worth cost for implementation and operation of each alternative are summarized below.

Alternative 1: Present Worth Cost - $ 550,100
Costs include installation of additional ground water monitoring wells and 30 years of monitor ing.

Alternative 2: Present Worth Cost - $ 739,400
Costs include installation of additional ground water monitoring wells, installation of individual treatment units (15 years of use), and 30 years of monitoring

Alternative 3: Present Worth Cost - $ 1,749,200
Costs include installation of additional ground water monitoring wells, installation of alternate water supply (25 years of use), and 30 years of monitoring.

Alternative 4: Present Worth Cost - $ 4,217,000
Costs include installation of additional groundwater monitoring wells, installation of groundwater extraction and treatment system (15 years of use) and 30 years of monitoring.

State Acceptance indicates whether, based on its review of the RI/FS and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative. This criterion will be addressed when State comments on the Proposed Plan are received.

Community Acceptance will be assessed in the Record of Decision following a review of the public comments received on the RI/FS reports and the Proposed Plan.

SUMMARY OF THE PREFERRED ALTERNATIVE

In summary, Alternative 4 actively removes contaminants from the groundwater and prevents the contaminants from potentially migrating to residential wells. In doing so, this alternative protects uncontaminated portions of the drinking water source from being contaminated. This alternative provides for restoration of the groundwater in a faster time period than the other alternatives.

This alternative also provides for the most protection of human health and the environment. Therefore, Alternative 4 is believed to provide the best balance of trade-offs with respect to the evaluation criteria and is proposed by EPA as the preferred alternative.

APPENDIX C

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION 2
FOR
MANNHEIM AVENUE SUPERFUND SITE

August 7, 1990
Meeting Attendees

(PLEASE PRINT)

Name	Address	City	State	Zip	Phone	Representing
FRANK CSULAK	26 FEDERAL PLAZA	NY	NY	10278	212-264-6785	NOAA/HMRB
GEORGE TAMNCIO	401 E. STATE ST	TRENTON	NJ	08625	609-984-3081	DEP/BCI
Robert Jones	430 W. Clarks Ldg.	Rd, Egg Harbor	N.J.	08215	609-965-2009	Resident
LILLIAN ESPINOSA	501 W. CLARKS LD	EHC	NJ	08215	9656413	"
Herman/Holly Lindeborn	507 Clarks Ldg	EHC	NJ	08215	965-7230	"
Trudy Krebs	400 W Clarks Lndg	EH	NJ	08215	965-2750	
CARRIE BERRET	357 N. MANNHEIM	E.H.	N.J.	08215	965-1894	RESIDENT
WILLIAM BATES	512 W. CLARKS LANDING RD.	EH.	N.J.	08215	965-2059	RESIDENT
MARGARET POEHNER	247 N ODESSA AVE	E.H.	NJ.	08215	965-1765	RESIDENT
George Jaeger	401 E. State	Trenton	NJ	08625	609 7721394	DEP/BEERA
Michael Cicali	201 S. Shore Rd.	Northfield	NJ	08225	609 645-7700	Atl. County Health.
Dan Crum	"	"	"	"	"	"
JOE KANE	358 N. MANNHEIM AVE	EGG HARBOR	NJ	08215	609-965-2170	RESIDENT
Robert GRAMS	340 N Mannheim	EggHarbor	NJ	08215	609 965 4997	Resident

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION 2
FOR
MANNHEIM AVENUE SUPERFUND SITE

August 7, 1990
Meeting Attendees

(PLEASE PRINT)

Name	Address	City	State	Zip	Phone	Representing
Virginia Lamb	300 E Jim Leeds Rd	Galloway	NJ	08201	609 652-3741	Galloway Tw
Lens Antunes	58 Sandpiper Dr	Voorhees	NJ	08043	424-2135	
[illegible] Schaier	725 W. Pine St.	Galloway	NJ	08213	965-3045	—
HAIYESH SHAH	NJDEP	TRENTON	NJ	08625	609 633-1455	NJDEP
Joseph Mendelsohn	NJ DEP	Trenton	NJ	08625	6092928424	NJDEP
Bob Howell	N.J. Pinelands Commission	New Lisbon	N.J.	08065	(609) 894-9342	

APPENDIX D

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY INVITES PUBLIC COMMENT ON THE PROPOSED REMEDY FOR THE MANNHEIM AVENUE SITE LOCATED IN GALLOWAY TOWNSHIP, NEW JERSEY

The United States Environmental Protection Agency (EPA), as lead agency for the Mannheim Avenue site, will hold a Public Meeting to discuss the Remedial Investigation/Feasibility Study (RI/FS) and the Proposed Plan for the Remedy at the site. The New Jersey Department of Environmental Protection (NJDEP), as the support agency, will also be in attendance. The meeting will be held on August 7, 1990, at 7:00 p.m. in the Atlantic County Library - Mays Landing, 2 South Farragut Avenue, Mays Landing, New Jersey.

As a result of the RI/FS conducted to date, EPA determined that the principal threat posed by the site is ground water contaminated with trichloroethylene (TCE), a suspected human carcinogen, which exceeds the State drinking water standard and has migrated off of the property boundary and may adversely impact residential drinking water wells. Among the options evaluated for addressing contaminated ground water at the site are the following:

1. No Action. This alternative would consist only of groundwater monitoring.

2. Point-of-Use Carbon AdsorptionTreatment/Water Use Restrictions. Under this alternative, individual carbon adsorption treatment systems would be installed and maintained at residential wells, if groundwater monitoring indicates that these wells are threatened.

3. Alternate Water Supply/Water Use Restrictions. Under this alternative, alternate water supply well(s) and a distribution system would provide a continuous source of clean water to residents, if groundwater monitoring indicates that residential wells are threatened.

4. Ground Water Pumping/Air Stripping/Reinjection. This alternative includes the installation of groundwater extraction wells to withdraw the contaminated water for on-site treatment with discharge through reinjection into the shallow and deep aquifers.

The No-Action alternative was evaluated as required by the National Oil and Hazardous Substances Pollution Contingency Plan.

Based on available information, the proposed remedy at this time is Alternative 4. EPA proposes that this remedy will be most protective of human health and the environment. EPA and NJDEP welcome the public's comments on all alternatives identified above. EPA will choose the Remedy after the public comment period ends and consultation with NJDEP is concluded. EPA may select an option other than the proposed alternative after consideration of all comments received.

Complete documentation of the project findings is presented in the Administrative Record File, which contains the RI and FS Reports and the Proposed Plan. These documents are available at either the Galloway Township Branch of the Atlantic County Library, 30 W. Jimmie Leeds Road, Pomona, New Jersey, or EPA's Region II office in New York.

The public may comment in person at the public meeting and/or may submit written comments through August 15, 1990 to:

Laura Lombardo
Remedial Project Manager
Emergency and Remedial Response Division
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278
(212) 264-6787